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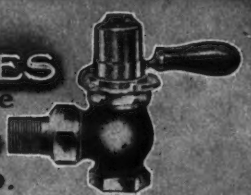

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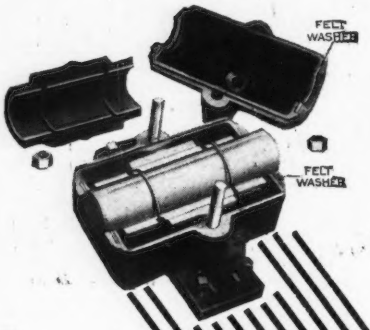

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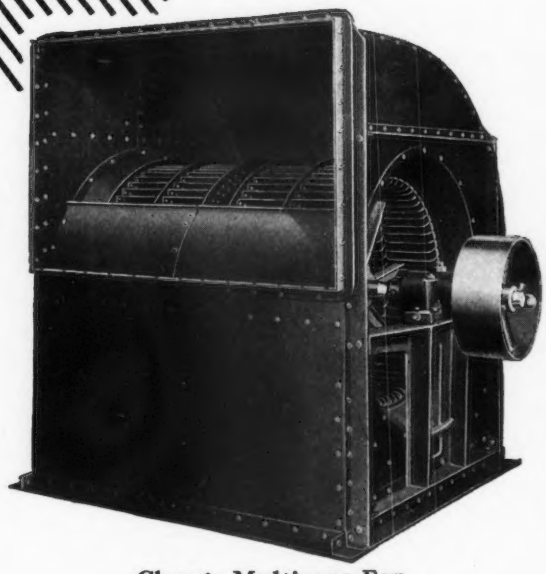

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THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. JUNE, 1918 1123 Broadway, New York

Inside Data on Central Station Heating

Practical Points, Gleaned from Long Experience, Covering Heating Mains, Fittings, Street Steam Traps, Service Connections and Consumers' Installations.

By W. H. FREHSEE,
Superintendent Steam Heating Department, Harrisburg (Pa.) Light and Power Company.

The Harrisburg (Pa.) Light & Power Company has 6¼ miles of underground steam heating mains, with 260 man-holes. The slip expansion-joint underground construction used in this system was first installed in 1886. Extensions have been made from time to time with the same type of construction. In 1900 the company adopted the American District Steam Company's construction, with variators and anchor specials, which eliminated man-holes, excepting where necessary to install valves or street traps.

All valves, fittings and bare pipe in man-holes are covered with 85% magnesia-block covering and plastered with asbestos plaster to a thickness of 4 in., and then painted with four coats of black water-proof paint to harden the insulation and make the fittings water-proof, as, in many cases, it was found that water would collect in the man-holes. The man-holes are also filled with shavings to the top of the valve stems.

All street traps are installed in separate man-holes. All slip expansion-joints in man-holes are covered with 85% magnesia-block covering and plastered and painted like the other fittings. Around each brass expansion-slip is placed a piece of galvanized iron, wired to cover the bolts and packing gland. The galvanized iron, in turn, is covered with 85% magnesia pipe covering, painted with four coats of black water-proof paint and finished with asbestos cement to make every part of the iron in the man-hole insulated. In the summer months, when the packing glands are re-packed, it is only necessary to take off the bands holding the covering, repack the glands and replace the same covering. Shavings are not placed in any man-hole having slip expansion-joints.

Through the procedure mentioned, it has been possible to lower the temperature in the man-holes by the thermometer reading to below 70° F. During the recent severe winter, with 1 ft. to 2 ft. of snow on the ground, covering the steam man-holes, 80% of these man-holes remained covered with snow throughout the cold period, showing that this careful insulation has more than paid in the conservation of steam.

There is no class of construction work which requires as much care in the selection of apparatus, or demands such direct attention, as the construction of underground steam heating mains and the design and installation of boiler-house equipment, particularly on account of the cost of installation. While it may be admitted that underground steam heating mains, properly designed, insulated and installed, cost more than any other type of underground construction, it is also true that, per dollar invested, the earning powers are greater. Operating reports containing accurate records of water evaporated at the plant and delivered into the heating mains, of transmission condensation, and of steam consumption in the buildings supplied, conclusively prove that the transmission

losses in properly-constructed and well-insulated underground steam heating mains may be made very low.

In this connection one point should not be overlooked, that is, that the loss as measured by qauntity does not depend on the volume delivered; the capacity may vary from 5% to 100%. The amount of condensation per square foot of steam main surface is increased or decreased directly in proportion to the degree of perfection in the insulation.

THE FACTOR OF FRICTION

In a well-insulated steam main, pressure drops are largely due to consumers' demands and to friction. Consumers' demands or use are a source of income to the company and, therefore, attention should be given to the remaining factor, friction. Friction can be reduced by not restricting the flow at the fittings, all of which should be of full area. Unnecessary angles and sharp, 90° ells should be avoided by using long-radius, sweep-angle tees. Friction, it should be remembered, necessitates increased pressure which increases the cost of steam production.

POWER STATION EQUIPMENT AND RECORDS

The installation in the power station relative to supplying either live or exhaust steam to the underground steam heating mains should have adequate boiler capacity for supplying all engines to care for the peak load and to supply steam to the heating mains. Such boilers should have automatic stokers, automatic feed-water pumps, hydraulic ash-wash systems, condensers, separators on exhaust lines, series of two traps each on separators, back-pressure valves, main valves and reducing-pressure valves, with by-passes supplying live steam to the underground steam heating mains. All live and exhaust steam mains, fittings, condensers, heaters, boilers, etc., should be covered with 85% magnesia covering.

In order to retain the highest heating operating efficiency, the following records should be kept:

Daily and monthly maximum, minimum and average outside temperature, by use of recording thermometers.

Daily and monthly maximum, minimum and average wind velocity, by use of hygrometer or hygrodeik.

Daily and monthly consumption of coal.

Daily and monthly evaporation of water, accounting for all steam made but which is not eventually delivered into the heating system.

Daily and monthly kilowatt output, using both recording and indicating meters.

TILE DRAINAGE UNDER STEAM HEATING MAINS

The installation of tile drainage is a very important factor preserving the life of the insulation of the underground steam heating mains. It should be installed with the true intent of maintaining the steam heating mains dry at all times. In making these drains a trench should be dug 18 in. deep, 12 in. wide on each side of trench below the grade stake set for the steam main, with cross sections to the two lines every 50 ft. Place 4 in. of No. 3 broken stone in the bottom of the tile trench, lay the 4-in. farm-drain tile on broken stone with ends butted together, place a tar-paper strip 4-in. wide over each joint, then fill the tile trench with broken stone to 4 in. across the width of the trench. Connect drain-tile lines to sewer at intervals of not more than 1000 ft. if the fall is in the same direction for that distance. When there are changes in the alignment of the steam mains, it will be necessary to connect to the sewer at shorter intervals.

The importance of this tile construction can be readily seen. The writer has taken out old steam heating mains

that had become too small, due to an increased demand for steam and for future extensions and has found, upon excavating, that the drain tile was completely filled with a silt foundation, making the tile under drainage of no value for the purpose originally intended. The tile had been laid in a bottom of clay or dirt soil, the joints being placed very unevenly or close together, one end being from ¼-in. to ½-in. open on the bottom. Seepage or surface water had percolated through the joints, softening the clay or dirt soil, embedding it in the trench and gradually filling it up.

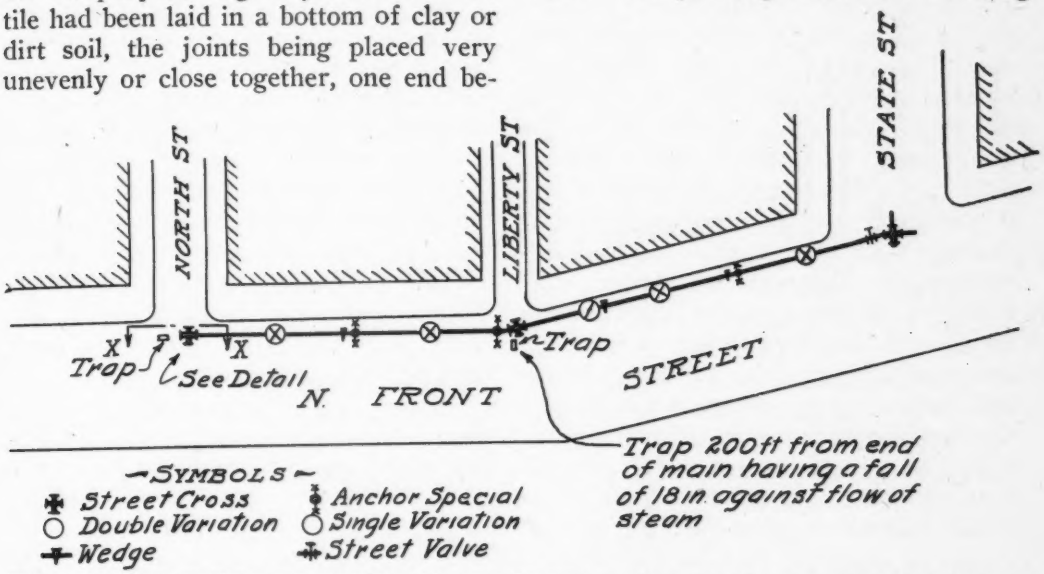


FIG. 1—ARRANGEMENT OF PIPING TO STEAM TRAP AT END OF ALL STEAM MAINS, REGARDLESS OF GRADE.

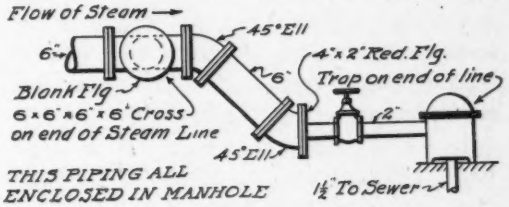
IMPORTANCE OF LEAKS.

A leak in the underground steam mains should be repaired immediately after evidence of the same is shown by surface or other indications. A small leak is often far-reaching in its results. The writer advocates using large-sized steam mains, reducing, when required, to the next smaller size, to lessen the drop in pressure due to friction. Small-sized mains and large reductions necessitate increased pressure at the plant. Large-sized steam mains have more area, giving greater volume with much less pressure.

All steam mains should be installed and insulated with the best type of covering to overcome condensation. Even fittings and bare pieces of pipe that are not covered by standard main insulation, should be covered with 85% magnesia-block covering and asbestos cement 2 in. thick, and then painted with black asphaltum. The painting makes the covering hard and water-proof. All brick boxes, man-holes, and brick ducts should be filled with shavings. Valves should be placed on all lateral mains and on main lines at least every third block.

STREET TRAPS

The installation of street traps is of vast importance in the maintenance and operation of the underground steam heating mains. A large number of central-station heating plants have no automatic water-feed regulators or pumps on the boilers. This is a very expensive mistake. The writer has found through



SECTION AT X—X (FIG. 1).

exhaustive tests on various central-station heating plants that a large amount of water and condensation gets in the heating mains due to the priming of the boilers or their being filled too full, due to careless hand-feeding. Also, when batteries of boilers are generating steam and from two to four of the boilers are not supplying their share of the steam, due to not having stokers or ash-wash systems, or to the fact that the fires need cleaning, making it necessary to fire the other boilers more rapidly and harder to make the desired pressure, these boilers siphon water to the steam heating mains, making saturated steam of a low heat-unit value. This saturated steam goes through the street mains and through the service connections into consumers' premises and registers on the consumers' meters. The saturated steam also requires more pressure at the central station and in the street mains and the consumers are compelled to carry additional weights on their reducing valves.

FITTINGS TO BE INSTALLED AT LOW POINTS

In all underground steam heating mains fittings should be installed at low points having drop bottom openings or pockets the same size as the pipe, also fittings should be installed every 1000 ft., regardless of grade. Take a 6-in. connection from the fitting direct to the trap in the manhole, this trap to be 2 ft. below the main. All fittings to the trap should be 45° ells.

On old steam heating mains, the writer has found a 2-in. tapping in bottom of cross at an intersection of streets at low grade and, 300 to 500 ft. beyond, the pipe grading back to this low point in the main to take care of all condensation. This arrangement, however, does not do so. The velocity carries steam and condensation up-grade to the ends of the mains into consumers' premises, registering on the meters.

It is very important to install a large-sized street trap from the end of the main or dead end, regardless of grade, in the man-hole, as shown in Fig. 1. The writer would advise installing a series of two large-sized steam traps in the manholes, as one trap may be out of service until inspected. A trap should be used that operates on various pressures, otherwise it will waste a large amount of steam before adjusting itself. Moreover, it is important that the trap should operate on less than 10 lbs. pressure. For that reason the writer, in his own practice, has installed one type of trap in manholes that will operate on from ½ lb. to 40 lbs. pressure. The writer also installs traps on the dead ends of street mains. In one instance, before these traps were installed, it cost $300 to $400 a month for repairs to street mains, due to water hammer and the resulting leaky joints and services. In one instance, with condensing coils and meters on the traps at dead ends of the line, the meter registration for the month of December, 1916, was 43,000 lbs., which, at 40 c. net per 1000 lbs., amounted to $172. In this connection it should be added that all street traps should be examined every week.

SERVICE CONNECTIONS TO CONSUMERS' PREMISES

All service connections should be taken off the top of fittings in the steam mains and graded back to the main. Fittings in service connections should be Y branches and 45° angle. No service connection should be less than 2½-in. in diameter, regardless of the small size of the building, as pipe above 2 in. has larger threads and more weight than the smaller sizes. Insist on large service connections to overcome pressure and friction by having the requisite area and volume. In our own experience, on the dead ends of a 4-in. or 5-in. steam main where, at times, the pressure was low, we had 1½-in. and 1¼-in. service connections and could not get any steam in the radiators. We insisted on running large service connections and on excavating we found from three to seven sharp,

90° ells in the service lines. The writer would insist on installing 2½-in. to 4-in. service connections with slight angles or 45° ells.

The following sizes of service connections are figured at 1lb. pressure:

Diameter, In.	Radiation, Sq. Ft.
2½	600
3	900
4	2200
5	3600
6	6000

All service connections to be installed same as street mains.

INSTALLATIONS IN CONSUMERS' PREMISES

The installation in consumers' premises increases or decreases the revenue derived from steam consumption in proportion to the satisfaction of the consumer in having his premises heated at a satisfactory rate. Therefore, examine all installations and have the consumer make all necessary changes. Keep a record of the character of the building, class of construction, thickness of walls, various exposures, single or double-glass thickness, tight or loose sash, tight-door sills, windows broken or not, cracks in walls. Also see that the foundation walls are tight, find cubic feet of space in building, square feet of radiation in building, type of installation, whether system is installed properly or not, changes to be made to system, and approximate cost of steam per season.

If the proposed consumer has a one or two-pipe indirect or vapor installation from his own boiler, would also record that, as outlined above. Check up radiation and space heated, examine the installation carefully and suggest any changes, having the consumer make same. By having the consumer remodel his installation according to the company's rules and regulations, much can be done in reducing the size of the meter bills.

The writer does not believe in supplying central heat to every one until the installations are made to conform with the company's rules and regulations. We would lose many consumers if we did not insist on this, due to large monthly bills.

When we have a complaint from a consumer about his monthly meter bill, we give it immediate attention. First we examine the street traps in the vicinity to see if they are working properly. Second, we examine all outside doors, windows, door sills or other openings. Third, we test the service connection coming in from the main. This last is most important, as with steam mains that have been installed for many years, when little attention was paid to construction as regards proper grade of traps or where there were not traps enough in the line, condensation and saturated steam from the mains will come in through the service connections and register on the meter.

ADJUSTMENT OF CHANGES WHEN METER FAILS TO REGISTER.

Where we have trouble with the meter not registering we adjust the bills according to the following table of percentages for the various months:

October	7%
November	13%
December	18%
January	18%
February	15%
March	16%
April	5%
May	5%

We have rules and regulations pertaining to service connections and all inside installations which the fitters must follow.

As already stated, we do not allow any 90° ells. All pipes are to be of a certain size for a given amount of radiation. All fittings must be covered.

No radiator connection from a riser is to be less than 1¼-in. Large-sized mains are insisted upon to give area and volume. Finally we heat our new in-

stallations to 72° F. in zero weather on from 1 oz. to 3 oz. pressure.

ESTIMATING THE HEATING COST FOR A NEW CONSUMER.

In estimating on a new consumer, in order to give him an idea of what the steam bills will be, we figure from $3.50 to $5.00 per 1000 cu. ft. of space per season, but we find that $4.00 per 1000 cu. ft. is within 10% of being correct.

VAPOR SYSTEM OF HEATING ADVOCATED.

We strongly advocate the use of the vapor system of heating as being the best to use with central station heating. While costing a little more to install, it is the most economical in the consumption of steam, saving from 20% to 25% over the ordinary steam systems. In fact, practically all of the installations now being made are of the vapor type. We would recommend in connection with the installing of a steam system the use of thermostats which, we believe; will pay for themselves in the saving of steam.

The following pipe sizes are recommended in connection with the installing of ordinary heating systems:

Radiation, Sq. Ft.	Pipe Size, In. Diam.
Up to 600	2½
600 to 900	3
900 to 1400	3½
1400 to 2000	4
2000 to 3000	5
3000 to 4500	6
4500 to 7000	7
7000 to 9000	8

Cross arms for small radiators should be 2 in. and, for larger-sized radiators, 2½ in., with risers 2 in. to first floor, 1½ in. to second floor and 1½ in. to third floor.

PIPE SIZES FOR VAPOR HEATING

The following pipe sizes are recommended for vapor heating systems:

Radiation Sq. Ft.	Main In. Diam.	Return In. Diam.
Up to 600	2½	1½
600 to 900	3	1½
900 to 1400	3½	1½
1400 to 2200	4	2
2200 to 3600	5	2
3600 to 6000	6	2½
6000 to 8500	7	2½

Cross arms for small radiators should be 2 in., with 1¼-in. return cross arms For larger radiators cross arms should be 2½-in., with 1¼-in. return cross arms. All connections to be taken off

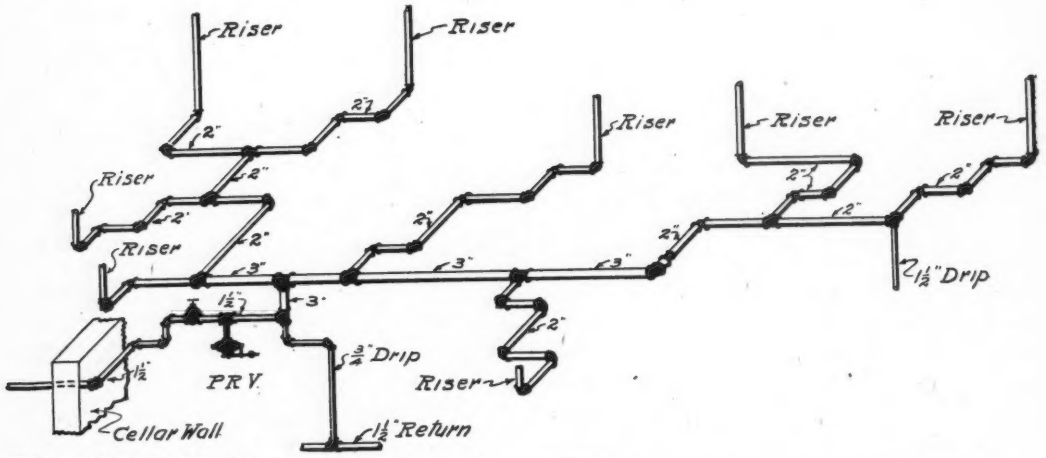


FIG. 3—OLD ONE- AND TWO-PIPE SYSTEM AS ORIGINALLY INSTALLED IN HARRISBURG BUILDING WHERE RADIATORS WOULD NOT HEAT.

with Y branches and 45° ells used in place of tees and straight ells.

CHARGES FOR CONSUMERS' INSTALLATION

In estimating for steam-fitting work for consumers we charge for everything in connection with the work, excepting the meter, which remains the property of the company. On a one-pipe steam heating job, our estimated contract price will average about $1.00 per square foot of direct radiation. On vapor installations, our contract price will average about $1.25 per square foot of radiation. For estimating the cost of running service pipes we use the following figures:

	Cost per Lineal Foot.
Excavating	$1.00
2½-in. pipe	.30
3-in. pipe	.40
4-in. pipe	.62
5-in. pipe	.83
6-in. pipe	1.08
7-in. pipe	1.20
8-in. pipe	1.35
5-in. wood-lined casing	.80
6-in. wood-lined casing	.90
8½-in. wood-lined casing	1.03
Repaving of street	.70
Labor laying service pipe	.50
Drayage, brick-work, etc.	.20

In installing steam heating jobs we figure on using economy coils containing 20% of the entire amount of radiation in the building, for cooling the condensation before it passes through the meter to the sewer.

PROVISION FOR TESTING PRESSURE ALONG LINE.

For testing pressure along the line at various points gauge connections should be installed to which a steam gauge can be attached at frequent intervals, especially during the extreme cold weather. This method of testing gives the amount of pressure along the line and is very important in reducing the pressure at the power station. Where pressure on dead ends is excessive, from 7 to 20 lbs., we reduce this to 2 lbs. on the last consumer on the extreme end of the line, thereby sending increased pressure to the low points along the line. By keeping close watch on these pressure points it is possible to reduce the pressure at the power station as much as 12%. These tests should be made once a month, or oftener, according to the weather.

POINTS ON THE USE OF METERS

The object of installing meters in consumers' premises is to bring about an equitable relation between the heating

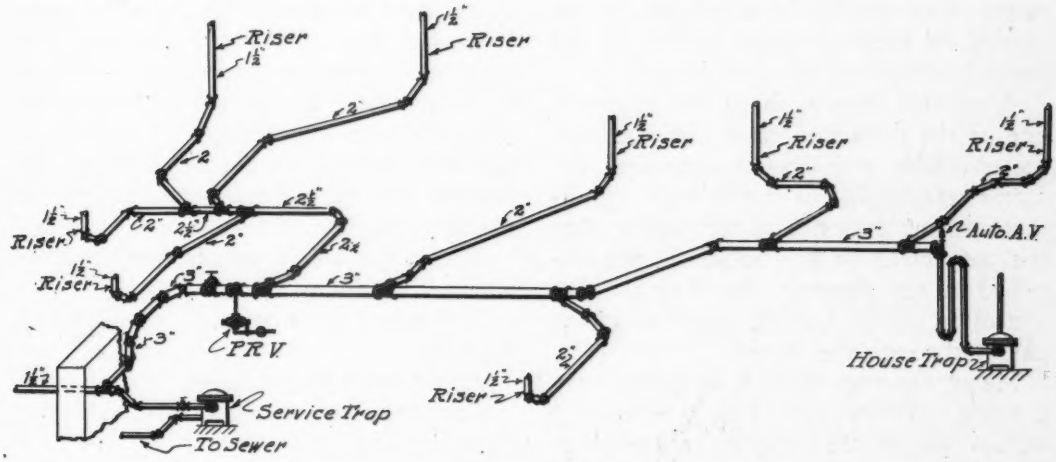


FIG. 4—CHANGES MADE IN OLD ONE- AND TWO-PIPE SYSTEM WHICH REMEDIED THE DIFFICULTY BY ELIMINATING 90° ELLS.

company and the customer, by recording the exact amount of steam delivered. The meter is connected to the extreme low point or end of the consumer's piping system, so that all the steam condensed in the building must be passed through before being discharged to the sewer. It is of the greatest importance that the meter should be of the proper capacity, the correct size being determined by definite rules. Otherwise, at maximum periods of flow, an accurate registration will not be obtained.

The proper-sized meter of the bucket type to install can be determined by multiplying the number of square feet of radiation in the building by 0.40. This will give the flow of water in pounds per hour. The proper meter can then be selected on the following basis: No. 2 meter, 150 lbs. per hour; No. 3 meter, 375 lbs. per hour; No. 4 meter, 750 lbs. per hour; No. 6 meter, 1500 lbs, per hour; No. 7 meter, 3000 lbs. per hour; and No. 8 meter, 15,000 lbs. per hour.

The meter must be set level. It should also be installed with a sufficient number of unions to permit of easy removal for cleaning and inspecting. The outlet of the meter should be located above the sewer to insure a free flow by gravity from the meter. The pipe should be as short as possible to insure free flow and the discharge pipe leading to the sewer should never be reduced in size. A sewer trap should in all cases, be installed to prevent water or sewer gas from backing up into the meter.

A careful inspection of the meter is one of the most important duties of the meter-reader who should note that the meter sets level, that meter seals are intact with no evidence of tampering, that the movement of the bucket is not impeded in any manner, and that all condensation from piping and radiators passes through the meter.

Meter readings should be taken once a week. At the end of each season all meters should be properly tagged, removed and taken to the testing-room where they should be tested, cleaned, their bearings lubricated, all adjustments made and then re-tested before being placed in the consumers' premises. The proper operation of all meters is of the greatest importance as upon their accuracy depends the confidence of the customers and the general public.

The following sizes of nozzles should be used on testing meters to insure proper rate of flow for the various meter sizes:

Meter.	Size of Nozzle, In. Diam.
No. 2	7/64
No. 3	11/64
No. 4	1/4
No. 5	23/64
No. 6	34/64
No. 7	3/4
No. 8	1
No. 10	2

SIMPLE METHOD OF TESTING METER.

Each compartment of the bucket of the meter is adjusted to empty when filled with the proper weight of water. The actual testing of a meter consists of weighing the amount of water contained in the barrel, noting the position of the bucket, up or down. The determined amount of water is then permitted to pass through the meter, after which scales are again balanced and the difference calculated, when a second reading of the meter and test dial is made. Meter buckets must be in the same position as at the beginning of the test. The comparison between the actual weight of the water and the recorded weight determines the percentage of accuracy. Careful records should be kept of the meters cleaned, adjusted and tested, together with date of test.

The essentials of proper meter operation are as follows:

The meter must be of proper size and capacity.

Meter must be set level.

Condensation should flow into meter from cooling coil.

Temperature of water should not be over 90° F. in going into meter.

Meter outlet must not be bushed.

Meters should be read and inspected frequently.

All meters should be tested at least once a year.

Proper facilities should be provided for testing meters.

As the care and operation of the meters are two of the most important factors in the success of central-station steam heating, this department should be placed in the charge of a skilled mechanic who will appreciate the importance of proper meter registration. Meters should not be tested on the consumers' premises, but in the testing-room at the power station.

Before testing meters, have all testing equipment examined by the sealer of weights and measures so that you will be sure your testing apparatus is correct. You will then have him to corroborate your statement in case of a controversy between the company and the consumer regarding the test made on the meter.

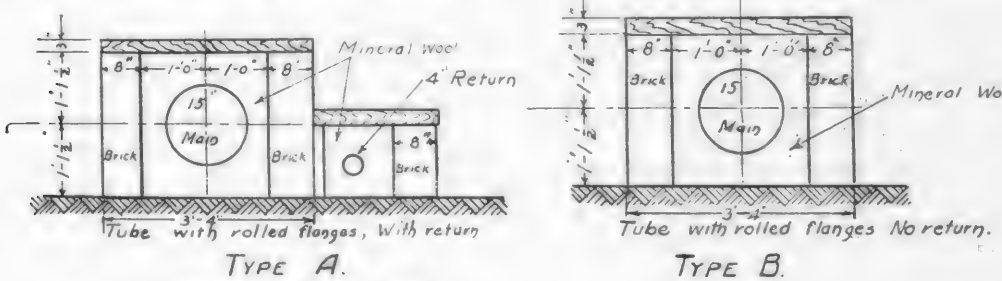
From the Old to the New in Steam Pipe Conduits

With Special Reference to the Types Developed by the New York Steam Company.

A moving picture of the development of underground pipe construction in New York City is afforded by the accompanying illustrations which show all the important changes made in the form of conduit used by the New York Steam Company since the original type was adopted in 1880.

In this original type (Type A), it will be noted that there was no underdrainage whatever and that the conduit was built with an earth bottom. It was evidently the opinion in those days that the losses downward were negligible. The pipe carried in this conduit was wrought-iron, rolled or expanded into cast-iron flanges, in similar fashion to the tubes in a boiler. Types A and B were used for approximately the ten-year period from 1880 to 1890. A type of construction (Type C), practically the same as Type B, but with screwed pipe and cast-iron screwed flanges, was used during the ten-year period from 1890 to 1900.

Underdrainage was first provided in the type adopted in 1900 (Type E), which remained standard for approximately the next ten years, or until 1910. This underdrainage consisted



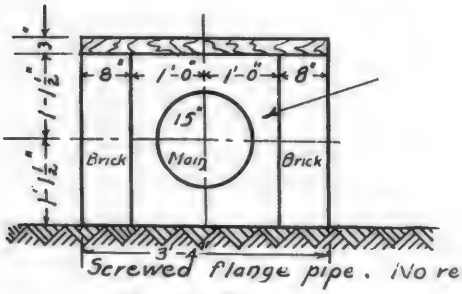
TYPE A.

No underdrainage—Earth bottom.

TYPE B.

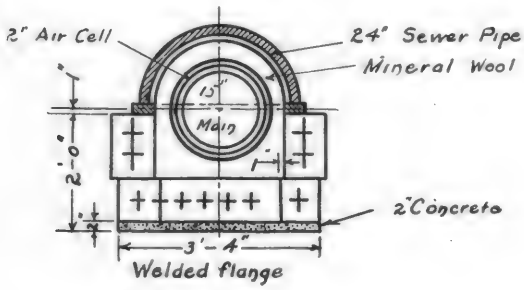
No return

ORIGINAL TYPES OF STREET MAIN CONSTRUCTION AS USED IN NEW YORK IN 1880.



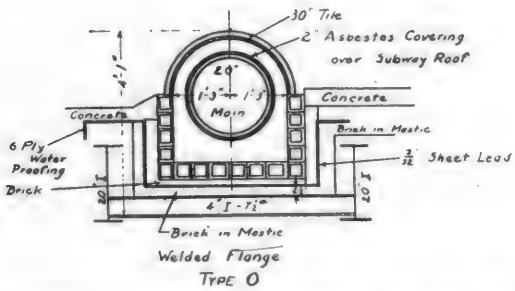
TYPE C.

CONSTRUCTION USED DURING THE PERIOD 1890 TO 1900.



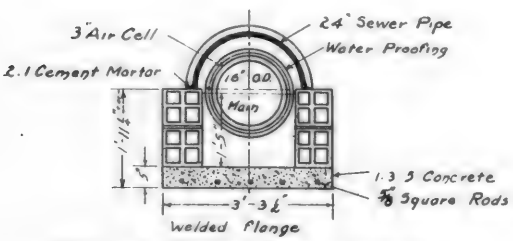
TYPE F

STANDARD CONSTRUCTION FOR FIVE-YEAR PERIOD TO 1915.



TYPE O

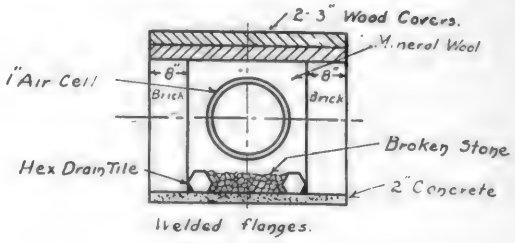
CONTEMPORARY WITH TYPE F, USED FOR SPECIAL SUBWAY WORK, WHERE CUT IS SHALLOW.



New style Expansion Joints and Anchorages

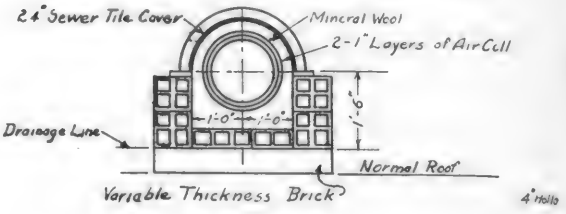
TYPE G

STANDARD CONSTRUCTION FOR 14-IN. AND 16-IN. MAINS SINCE 1915.



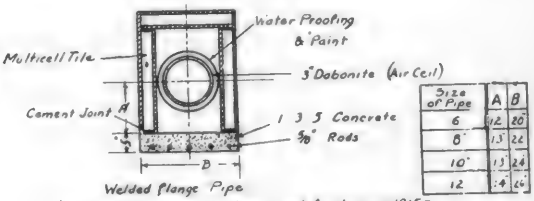
TYPE E

CONSTRUCTION FOR TEN-YEAR PERIOD APPROXIMATELY FROM 1900 TO 1910.



Approved by the Bureau of Subsurface Structures.

CONTEMPORARY WITH TYPE F. USED FOR SPECIAL SUBWAY WORK WHERE CUT IS SHALLOW.

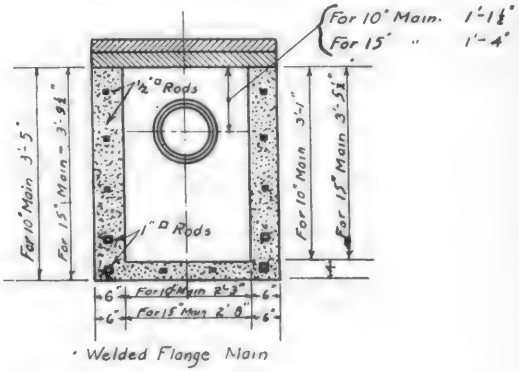


Size of Pipe	A	B
6	12	20
8	13	22
10	13	24
12	14	26

New style Expansion Joints and Anchorage 1915

TYPE H

STANDARD CONSTRUCTION SINCE 1915 FOR MAINS UP TO AND INCLUDING 12-IN. PIPE.

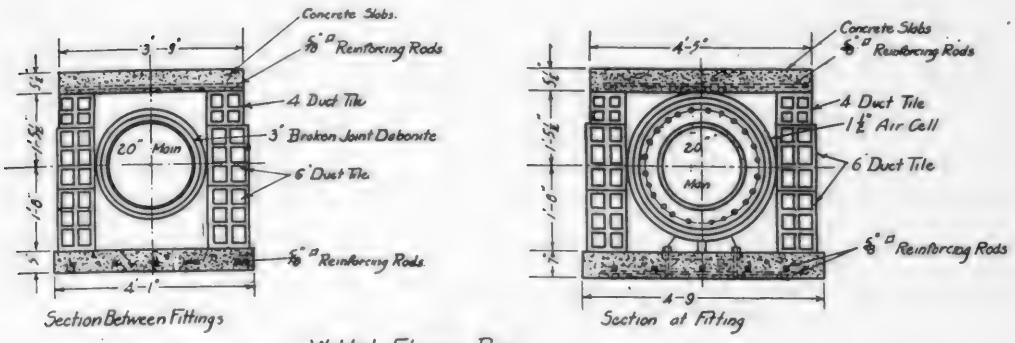


Reinforced Concrete Trench

Supported by Concrete piers on tunnel roof

TYPE M

SPECIAL CONSTRUCTION, CONTEMPORARY WITH TYPE E, USED FOR STRENGTH OVER DEEP BACK-FILL.



Welded Flange Pipe

For detail of Roof Slabs see the Burling Engineering & Const. Corp Standards (D-11)

TYPE V

STANDARD CONSTRUCTION SINCE 1915 FOR 20-IN. MAINS.

of broken stone held in place by hexagonal drain tile and resting on a bottom of concrete 2 in. thick.

Type F is the general form of construction used from 1910 to 1915. This has a 2-in. concrete floor, but no reinforcing and the space between the sectional covering and the housing was filled with mineral wool. A conduit was also placed beneath the pipe, serving as a drainage space and to support the mineral wool.

Type G, with reinforced concrete base, 3 in. of sectional covering, no mineral wool and merely an open space for drainage beneath the pipe, was first used in 1915 for all sizes of pipe.

In 1916 the so-called standard multicell construction (Type H) was used for pipe sizes up to 12 in. in diameter only, while Type G was continued for 14-in. and 16-in. pipe and Type V for 20-in. pipe.

Type M is contemporary with Type E and was used where mains were restored over the Hudson & Manhattan tubes where there was a backfill of from 10 ft. to 18 ft. over the tubes. The reinforced concrete box was supported by concrete piers extending down to the roof of the tunnel, the box serving as a bridge between piers set 20 ft. apart.

Type N is contemporary with Type F, but was used only on the subway roof where there was but little space between the subway roof and the street paving.

The construction shown in Type O is contemporary with the Type F and was used in the Sixtieth Street crossing of the Lexington Avenue subway where the cross pipe had to be kept at as low a level as possible to accommodate the longitudinal subsurface structures in Lexington Avenue. Type Q was also in use at the same period as Type F, and was for the same purpose, but possibly under slightly different conditions than Type N.

Figuring Steam Consumption in Radiation

Amount Required Per Square Foot of Direct Required Radiation To Maintain an Inside Temperature of 70° F., with Various Outside Temperatures.

BY J. A. STRAWN

Other conditions being equal, the heat loss from a building is, of course, proportional to the temperature rise; that is, to the difference between the temperature of the building and the outside air. As the condensation recorded by the meter attached to the system served by a central station heating plant is very nearly proportional to the heat loss from the building, this may be expressed in equational form as follows:

$$\frac{C}{R} = f\ (T_B - To) \qquad (1)$$

In which C = condensation in pounds per day.

R = direct radiation required in square feet.

f = Factor depending upon kind of system, character of building, quality of regulations, etc. This factor has been found very nearly constant for any one of a large number of buildings observed.

T_B = Inside, or building, temperature.

To = Average outside temperature for the days considered.

Transposing and substituting 70° for T_B:

$$f = \frac{C}{R\ (70 - T)}$$

But the condensation per hour from a square foot of direct radiation under 1 lb. steam pressure giving up 250 B.T.U. is 250/971.2 = 0.258 lbs.

Adding 10% for condensation losses in mains, risers, etc., and letting x = number of hours per day that steam is necessary at various outdoor temperatures:

$$f = \frac{0.284\ x}{R\ (70 - T)}$$

When R = 1, To = — 10° (the system is assumed to be in use 24 hours per day) and f = 0.0853.

Then

$$x = \frac{0.0853\ (70 - To)}{0.284} = 0.3(70 - To)$$

Computed values of x for various outdoor temperatures are as follows:

Outdoor Temperature Degrees F.	Hours of Use
—10	24
0	21
10	18
20	15
30	12
40	9
50	6
60	3
70	0

Charts obtained from a recording instrument, the pen of which was actuated by the stem of the reducing valve in the heating system of a thermostatically-controlled building have shown that the hours of use computed above for various temperatures are reasonably accurate.

Equation (1) has been found very useful by the writer in estimating consumption in cases where a meter had stopped, or given a faulty registration for any cause. It has been found,

however, that it is not as applicable to consumptions of customers operating under flat rates as to the consumptions of customers operating under meter rates, as the former class is much more liable to cool rooms by means of open doors and windows, than to prevent overheating those rooms by shutting off the steam supply automatically or otherwise.

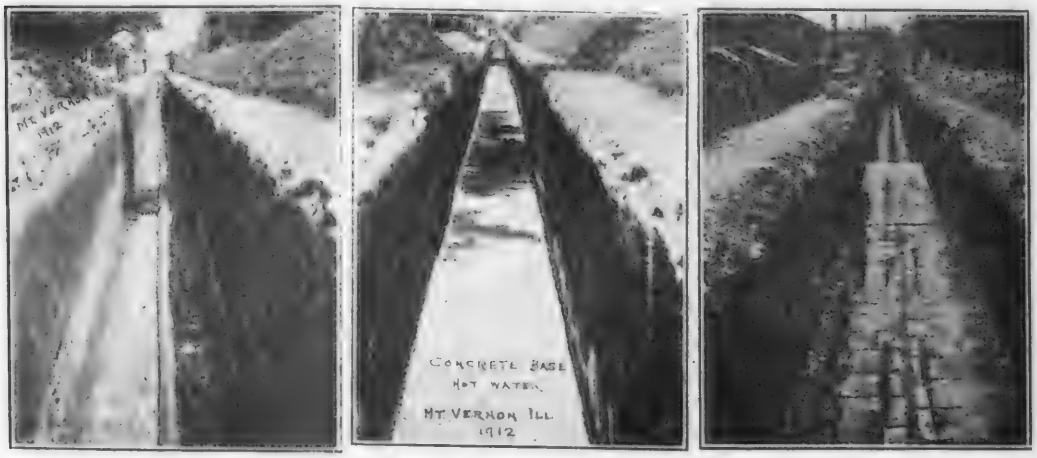
Problems in Underground Pipe Construction

A Study in Contrasts Between the Character of the Work in Medium-Sized Cities and in the Downtown District of New York.

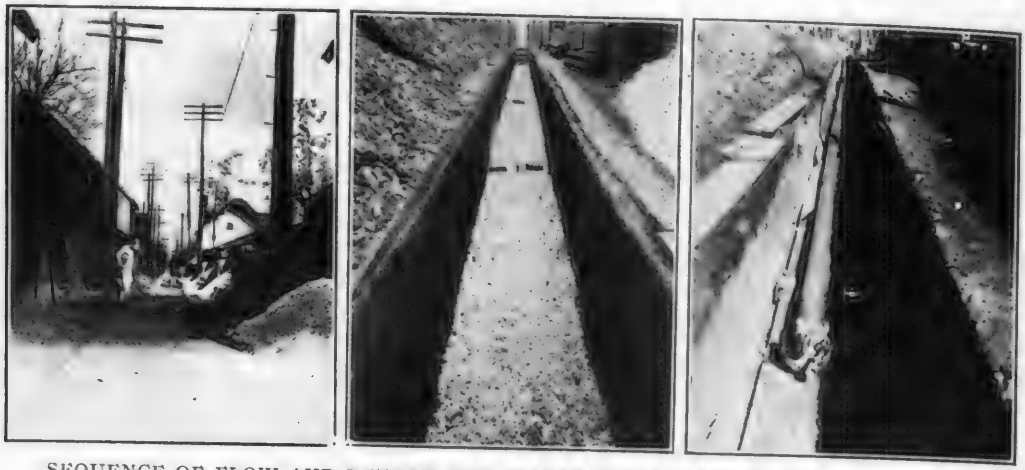
The accompanying views, taken "on the job," are typical of present-day underground pipe construction for central station heating systems and, to a degree, tell their own story. It will be observed that in the ordinary run of underground piping there is fairly plain sailing. Obstructions such as those shown in the Harrisburg, Pa., installation are somewhat out of the ordinary, while those shown in the downtown New York district are in a class by themselves.

For months the downtown street corners in New York have resembled mining excavations, and the patience of the public has been well-nigh exhausted in waiting for the various runs and twists of piping to be untangled and put in shape so that the street could be properly surfaced. A study, however, of the typical situations shown herewith will make it

OBSTRUCTIONS IN HARRISBURG, PA., PIPE TRENCH.



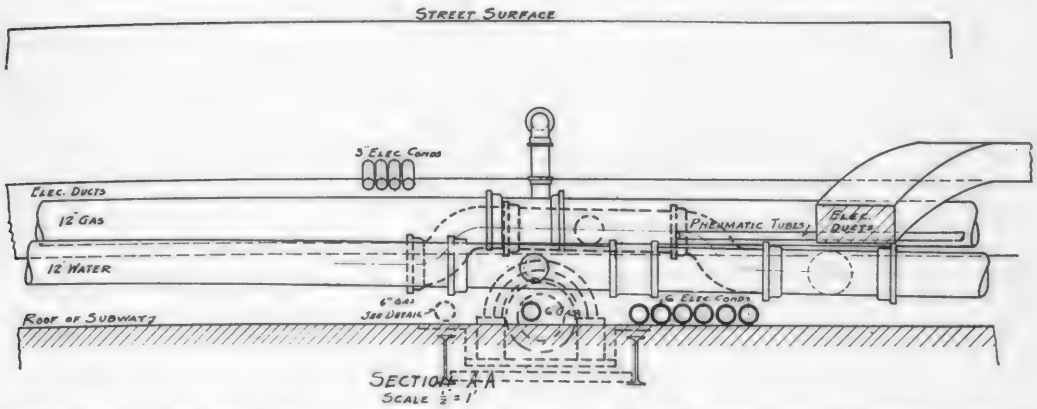
SEQUENCE OF FLOW AND RETURN HOT WATER INSTALLATION, MT. VERNON, ILL.



SEQUENCE OF FLOW AND RETURN HOT WATER INSTALLATION, SPRINGFIELD, ILL.

SEQUENCE OF STEAM MAIN INSTALLATION, ANDERSON, IND.

SEQUENCE OF FLOW AND RETURN HOT WATER INSTALLATION, SPRINGFIELD, ILL.

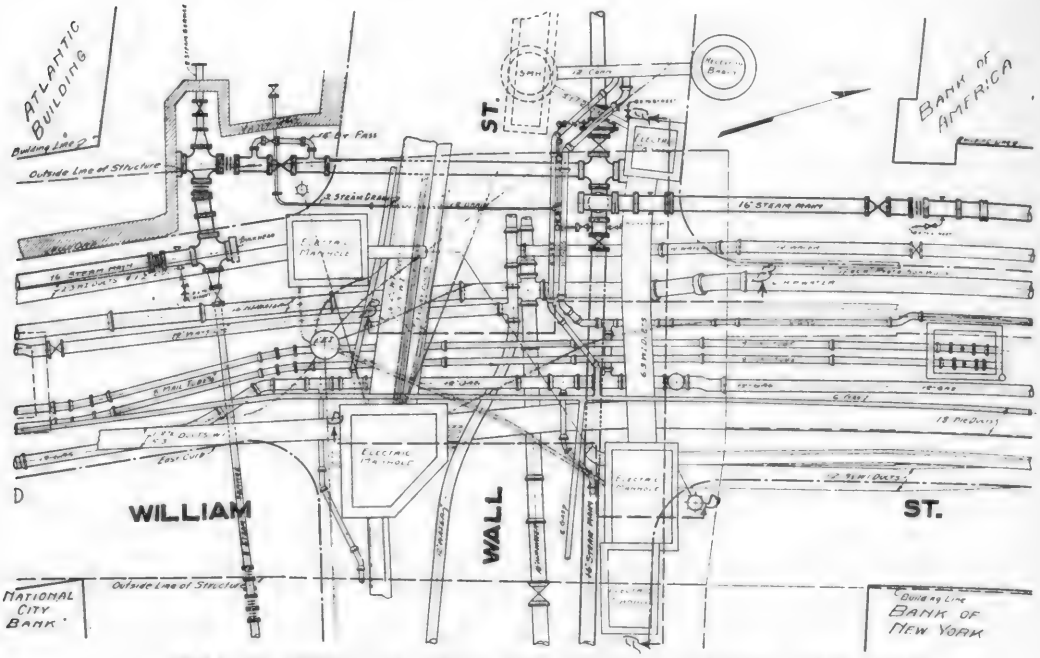


ONE OF THE MANY PROBLEMS AT THE INTERSECTION OF CEDAR STREET AND BROADWAY, NEW YORK.

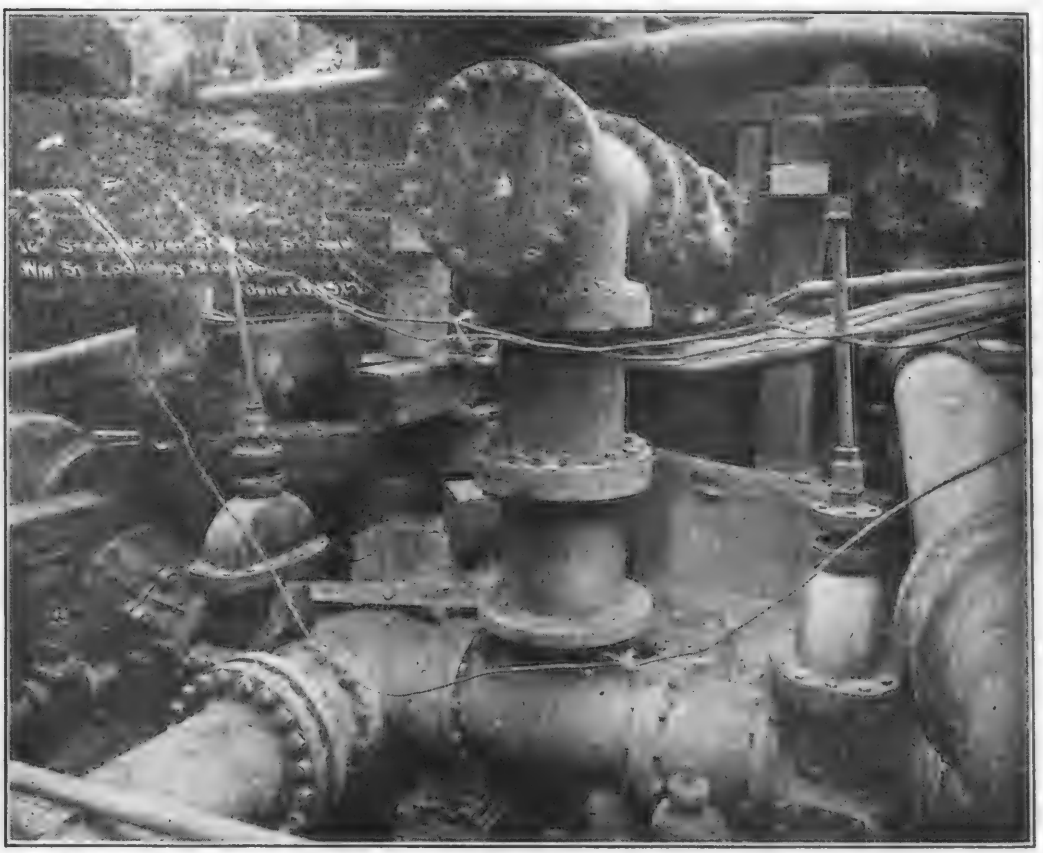
apparent at once to those experienced in this class of work why it was that the streets were open so long and the wonder is, not that it took so many weeks and months to effect a satisfactory arrangement of the piping, but that it was possible to make any arrangement at all capable of giving service.

The illustrations of the New York streets are intended to feature in particular the mains of the New York Steam Company, which company has been engaged for some time in re-

CONDITIONS ENCOUNTERED AT WALL AND WILLIAM STREETS, NEW YORK.



PLAN OF PIPING AT WALL AND WILLIAM STREETS, NEW YORK.



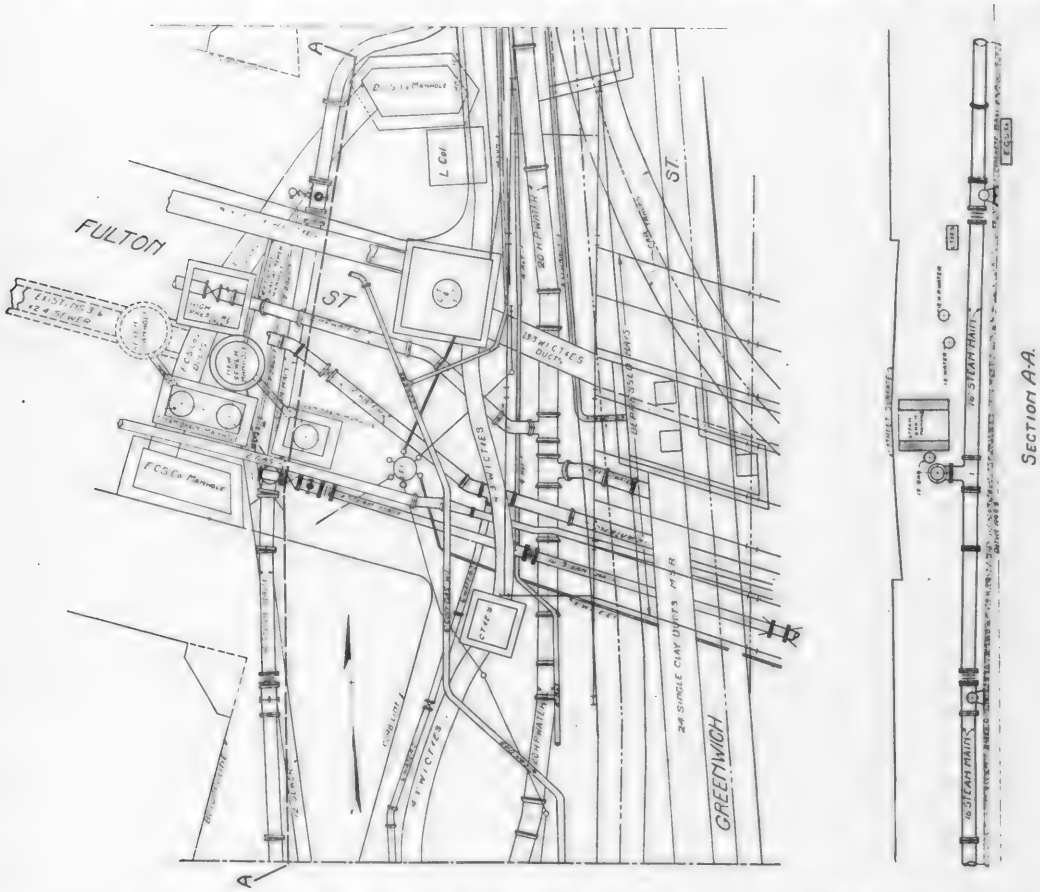
DETAIL OF 16-IN. STEAM RISER AT WALL AND WILLIAM STREETS, NEW YORK.

building its pipe lines. H. A. Fisher, engineer of underground construction for the New York Steam Company, through whose courtesy the accompanying pictures were obtained, states:

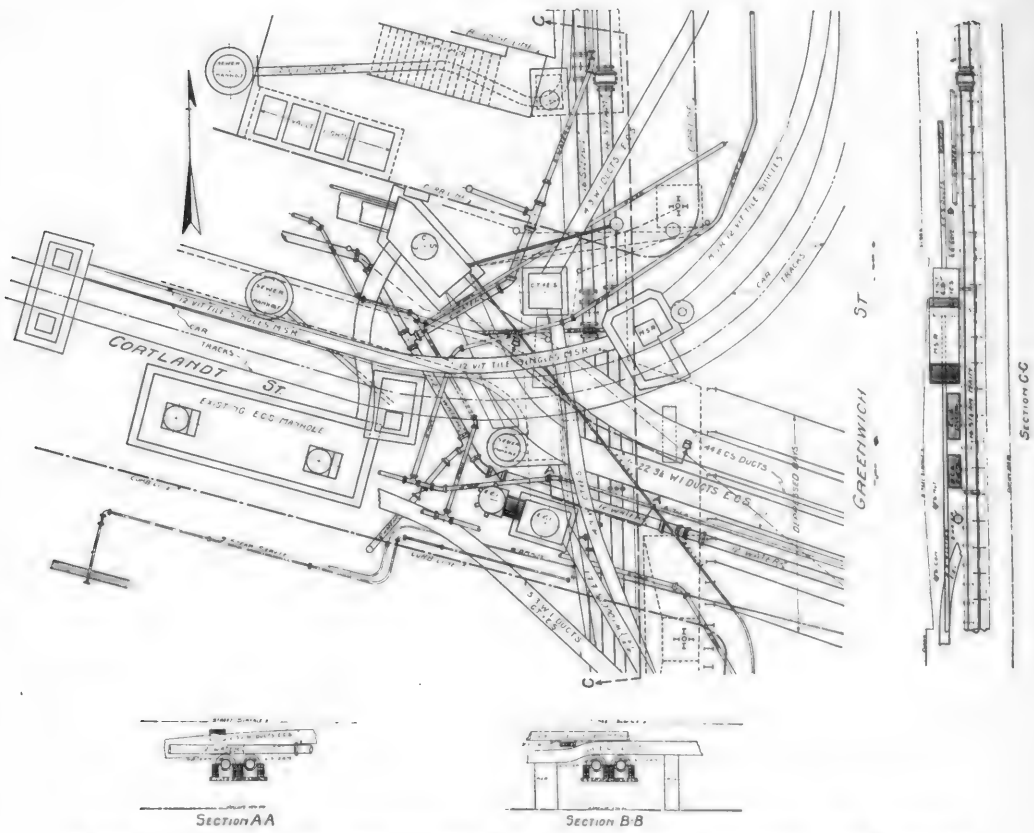
"I do not know of an obstruction to the installation of underground mains that we have not had to contend with within the limits of our system, from rock to quicksand, underground springs to tidewater, and from supporting elevated column footings to underpinning of buildings."

Special attention is called to the drawings of the piping tangles at Cedar Street and Broadway, Wall and William Streets, Greenwich and Cortlandt Streets and Fulton and Greenwich Streets. These drawings will repay close study as they reveal many of the difficulties encountered.

Taking the view showing the intersection of Cedar Street and Broadway, where a 16-in. main is installed, it was necessary to alter every structure at the intersection, involving innumerable preliminary designs and sketches for use in connection with securing consents from the various companies involved. Two 12-in. and one 24-in. water main and one 20-in. gas main had to be raised, Commercial cables shifted to a new position, Consolidated Telegraph & Electric Subway Company's manhole altered and subway ducts raised, vault of building changed, Empire Subway Company's bank of ducts shifted to the north, a depressed bay installed between bends of roof structure of the interborough subway, duct lines and water main moved to facilitate the placing of a special bend of the steam



PLAN OF PIPING AT FULTON AND GREENWICH STREETS, NEW YORK.



PLAN OF PIPING AT CORTLANDT AND GREENWICH STREETS, NEW YORK.

main, and the yoke supports of the New York City Railway Company changed, and new drains installed to sewers. All work during week days was done beneath the street decking; traffic had to be maintained at all times. Work on the depressed bay of the subway roof had to be done at night, at which time the tracks below were carefully patrolled.

Another set of conditions was encountered at Wall and William Streets, also in connection with one of the steam company's 16-in. mains. Due to the net work of subsurface structures at this intersection, it was necessary to install the mains underneath the sidewalk (the only available space) in William Street, connecting to the Wall Street main through structures built at a depth of 11 ft. Various types of special fittings were used as shown in the close-up photograph, such as anchor service box, valve dummy of extra heavy standard, and changed drill casting, variators, service spools and valves of New York Steam Company standard. This intersection is typical of several in William Street. It may be interesting to note in the plan the by-pass of the 16-in. main valve, at the southwest corner, with 8-in. service to the Atlantic Building and the 8-in. service to the National City Bank.

The double line in Greenwich Street, at Cortlandt Street, and the main at Fulton and Greenwich Streets, were installed under the sidewalk on account of the extreme height of the subway, the roof of which at Cortlandt Street, is about 2 in. below the street surface.

CHICAGO COMMISSION ON VENTILATION

Report on Air Conditions at the Paris Garter Factory

II

EDITED BY HARRY M. HART.

(Concluded from May issue.)

The first part of this report gave details of the tests made on various floors under normal operating conditions. The concluding portion of the report, here published, deals with a series of tests showing the effect of the exhaust fans and nautral ventilators at the ceiling of the top floor on the air movement throughout the building. There is also included a discussion of both series of tests.

Test No. 10, March 3, 1917, 5th Floor.

All doors and windows closed.
Outside weather conditions—Temp. 32°
Relative humidity 90%.
Direction of wind,—N-NW.
Velocity—9 miles per hour.
Time—10:00 A.M.

Exhaust Fans:

North exhaust fan, speed 600 RPM, velocity 1230,
Volume 8680 CFM.
South Fan, speed 588 RPM, velocity 1140, Volume 8060 CFM.

Globe Ventilators:

2 closed—6 open.
Average negative velocity through ventilators 160-ft. per minute.
Total, 3072 CFM.
Average temperature of the room 71°F.
Average relative humidity—22⅔%
Average CO_2—5.46
Temp. of air discharged through exhaust fans, 72°F.
Relative humidity of same—20%.

The results of above test show that fans were exhausting a total of 16,740 CFM. 3072 CFM. was coming into the room through the Globe ventilators and the balance was coming into the room through the cracks and crevices around the doors and windows.

During this test, complaint was made of the cold drafts near all the windows, indicating excessive inward leakage at these points, also objectionable odors near toilet adjacent to elevator.

The absurdity of having both exhaust fans and gravity ventilators in one room is shown very well in this test where the large volume of air handled by the fans caused a down draft into the room through the ventilators. Probably very little of the air pulled through the ventilators ever reached the breathing zone, as both fan and ventilators are in or near the ceiling.

The uncomfortably cold drafts near the windows as well as the objectionable odor near the toilet illustrates the necessity of providing some definite entrance for the air when exhaust fans are used, instead of depending on leakage.

The amount of heating surface installed on this floor is barely sufficient to compensate for the direct heat losses when the outside temperature is 10°, and has no excess capacity to care for warming the air for ventilation. Consequently the normal operation in cool or cold weather is to ignore the exhaust fans and depend on gravity ventilation alone.

Under the conditions in effect at this time this test was made, the doors from the toilet-rooms acted as air supply openings and odors entered the room from both toilets. The toilet adjacent to the elevator shafts naturally is a greater offender in this respect than the other, the air being doubly

polluted as it must first pass from one of the lower floors through the toilet on that floor to the elevator shaft, up the shaft and through the toilet on the fifth floor into the main room.

The design of the plant in this particular cannot be too strongly condemned. The elevator shaft should not be permitted to act as a vent flue in any event, particularly of toilet rooms, as in this case.

Test No. 11, March 5th, 1917, 5th Floor.

All doors closed and three windows slightly open.
Outside weather conditions—Temp. 24½°F.
Relative humidity—75%.
Direction of wind—NE.
Velocity—4 miles per hour.
Time—4:00 P.M.

Exhaust Fans:

North exhaust fan, speed 200 R.P.M., velocity 283.
Volume 1985 C.F.M.
South fan, speed 206, R.P.M., velocity 295.
Volume 2065 C.F.M.

Globe Ventilators:

2 closed—6 open.
Average positive velocity through ventilators 150 ft. per minute.
Total 2880 C.F.M.
Average temp. of the room 72°F.
Average relative humidity 17½%.
Average CO_2—
Temp. of air discharged through exhaust fans, 75°F.
Relative humidity of same, 17%.

The results of the above test show that the fans were exhausting a total of 4050 C.F.M. and the Globe ventilators 2880 C.F.M.

As near as could be measured, 1850 C.F.M. was coming in through the open windows and the balance of the air was leaking through the doors and crevices

Objectionable cold drafts near all windows were very noticeable to the occupants, also objectionable odors near toilet adjacent to elevator.

Test No. 11 is almost a duplicate of No. 10, the only difference being that a few windows were open and that the exhaust fans were running much more slowly, only 4050 C. F. M. being exhausted instead of 16,740, as in test No. 10. The suction of the fans at this speed was not great enough to cause a reversal of the natural air currents through the ventilators. The same remarks which were made about test No. 10 apply here also.

Test No. 12, March 7, 1917, 5th Floor.

All doors closed, 5 windows slightly open.
Outside weather conditions—Temp. 40½°F.
Relative humidity 65%.
Direction of wind—SW.
Velocity—17 miles per hour.
Time—

Exhaust Fans:

North exhaust fan, speed 572 R.P.M. velocity 1175.
Volume 8225 C.F.M.
South Fan, speed 572 R.P.M., velocity 1100,
Volume 7700 C.F.M.

Globe Ventilators:

2 closed, 6 open.
No velocity in either direction indicated through the ventilators.
Average temperature of the room, 70 2/7°F.
Average relative humidity—28%.
Average CO_2.
Temp. of air discharged through exhaust fans—77°F.
Relative humidity of same, 20%.

The results of the above test indicated that the fans were exhausting 15,925 C.F.M. from the room, of which approximately 11,445 C.F.M was coming in through the open windows, the balance leaking in through cracks and crevices.

Objectionable cold drafts near all windows were very noticeable to the occupants, also objectionable odors near toilet adjacent to elevator.

The opening of several windows gave an inlet for the air, so that it was not compelled to come down through the ventilators, the suction of the fan being just sufficient to balance the pull of the ventilators, there being no motion through them in either direction. In other respects, the conditions observed were about the same as in tests Nos. 10 and 11.

These tests, Nos. 10, 11 and 12 each covered only a short period of time. It would be interesting to know how long the exhaust fan could be run before the incoming cold air lowered the temperature of the room to such a point as to cause marked physical discomfort to the occupants. The shortage of radiation on this floor makes the maintenance of a proper temperature inside in sub-zero weather impossible when the fans are running at full speed.

Test No. 13, March 12, 1917. Basement to 5th Floors Inclusive.

Windows on all floors partially open, all corridors open.

Outside weather conditions—Temperature 36.5°F.
Relative humidity—66%.
Direction of wind—E-NE.
Velocity 7 miles per hour.
Time—1:30 P.M. to 2:30 P.M.

Exhaust Fans:

Not running.

Globe Ventilators:

Six open—2 closed.
Average exhaust velocity through ventilators, 490-ft. per minute.
Total volume—9400 C.F.M.

Observations taken at each corridor door on each floor indicate the following results:

Room:	Velocity N. E. Door Feet per min.	Velocity S. W. Door Feet per min.	Total Volume Cu.Ft.	
Basement	—20	0	—540	
1st floor	—125	—85	—5670	— 105 C.F.M. per person
2nd floor	—215	—150	—9755	— 44.4 C.F.M. per person
3rd floor	—150	0	—4050	— 17.9 C.F.M. per person
			—20015	—20015 Average 32 C. F. M. per person.
4th floor	+165	+190	+9585	
5th floor	+200	+170	+9990	+19570

The following windows were open on the 4th floor, through all of which the air was going out:

North Wall—4 windows open. 6 in. x 4 ft. each
East Wall—2 windows open. 6 in. x 4 ft. each
South Wall—2 windows open. 24 in. x 3 ft. each
West Wall—3 windows open. 6 in. x 4 ft. each

CO_2 tests, 5th floor, taken at frequent intervals indicated the following:

1:30 P.M.—fans not running, 30 min. after 1st test.

North-east Stair Hall CO_2	South-west Stair Hall CO_2
5.6	5.5
5.4	5.3
5.5	4.9

NOTE:

(—) Indicated air movement from room into halls.

(+) Indicated air movement from hall into rooms.

This test is interesting because it shows so closely the well-known effect of air pressures around tall buildings, showing a strong pressure inward in the lower stories, a neutral zone, and a strong pressure outward in the upper stories. The effect of the opening of windows is very noticeable as the 12 sq. ft.—open window area on the fourth floor caused it to have nearly as great an air movement as the fifth floor, with its presumably more efficient roof ventilators.

The quantity of air moved throughout the building was quite large, averaging 32 cu. ft. per occupant—per minute. The quality of that portion of it which entered the fifth floor from the stair hall was not especially good, as the CO_2 contents averaged 5.36 whereas the outside CO_2 probably was not over 4 points, indicating that some contamination of the air had taken place. As there was only a comparatively small number of employees on this floor (81, each having 2000 cu. ft. of air space) the CO_2 probably rose only slightly higher. Had this floor been a crowded one, such as the second or third with over 200 employees, the condition of the air entering the rooms as it did with an initial contamination, probably would have become very bad before it escaped by the fans or ventilators.

Test No. 14, March 12, 1917. Basement to 5th Floors Inclusive.

Test No. 12 was repeated with all windows on the 4th floor closed, fans not running, giving results as follows: (see page 40).

Closing the windows on the fourth floor seems to have had three effects: First—the volume of air moved throughout the building was cut down about 4000 C. F. M.; second, the neutral zone shifted so as to place the third floor in the upper, or outward pressure, portion of the building instead of in the lower, as in test No. 13; and third—a surprising reduction of over 7000 C. F. M. in the amount of air going to the fourth floor took place, the amount going to the fifth floor increasing at the same time.

The large part played by the open windows in this and the 13th test, shows the undesirability of depending on them for a continuous supply of air.

The considerable volume of air going to the fifth floor shows the strong draft created by the ventilators, which pulled 80% of the air coming into the building on the lower floors, up to the top, leaving the third and fourth floors with a marked deficiency of air

supply. Thus, the ventilators were a help to the ventilation of the fifth floor, but a detriment to the ventilation of the third and fourth floors.

Room:	Velocity N. E. Door Feet per min.	Velocity S. W. Door Feet per min.	Total Volume Cu.Ft.		
Basement	0	0	0		
1st floor	—150	—120	—7300		
2nd floor	—215	—130	—9315		
				—16615	Average 26 C. F. M. per person.
3rd floor	0	50	1350		
4th floor	40	50	2430		
5th floor	250	195	12015		
				+15795	

Test No. 15.

The above tests were then repeated with 4th floor windows open, as in test No. 13, and exhaust fans running, as follows:

North exhaust fan,	speed	670 R.P.M.
Velocity		1425 F.P.M.
Volume		9975 C.F.M.
South Fan,	speed	600 R.P.M.
Velocity		1380 F.P.M.
Volume		9660 C.F.M.

Globe Ventilators:

6 Ventilators open.
Average velocity 320 F.P.M.
Volume 6144 cu. ft.
Total 25779 cu. ft.

Room:	Velocity N. E. Door Feet per min.	Velocity S. W. Door Feet per min.	Total Volume Cu.Ft.		
Basement	—200	0	—540		
1st Floor	—270	—210	—12960	54 persons—240	C.F.M. each
2nd Floor	—240	—100	—9180	219 persons— 42	C.F.M. each
3rd Floor	—135	—10	—3915	226 persons— 17.3	C.F.M. each
			—26595		
4th Floor	100	175	7425	29 persons— 25.6	C.F.M. each
5th Floor	490	460	25650	81 persons—316	C.F.M. each
			+33075		

Total persons.....609
Total air movement.....33075 C.F.M.
Average per person.....54.5 C.F.M.

4:00 P.M. Fans running full speed 1½ hrs. after third test.

Northeast stair hall	Southwest stair hall
CO_2	CO_2
4.6	4.9
5.0	4.7
5.4	5.0

	CO_2
Northwest corner of room	5.7
Center of room	6.8
Southeast corner of room	5.9
North exhaust fan	5.0—6.2
South exhaust fan	5.9

The use of the exhaust fans naturally caused a general increase in the amount of air moved. The almost exact correspondence between the amount of air passing through the fans and ventilators on the fifth floor (25779) with the amount entering the room through the stair hall doors (25650) indicates that the suction of the fans and ventilators was just sufficient to balance the natural outward pressure of the air through and around the windows.

The ratio of window area to floor area (1 to 7.5) is such that taken in connection with the shape of the building and the arrangement of windows on all four sides, a very well lighted building results.

The work done in this shop is light manufacturing, and there is nothing in the processes carried on which would cause especial contamination of the air. Some excess radiation has been provided to heat the incoming air, but the amount of this excess is only sufficient to warm about 7,000 C.F.M. in —10° weather. Adding the amount of heat radiated by the occupants brings the total amount of cold air which can be introduced, up to about 10,000

DATA	2nd	3rd	5th
Ratio window area to floor area	1 to 7.56	1 to 7.56	1 to 4.65
Ratio window area to cu. contents	1 to 75.6	1 to 77	1 to 46.5
C. F. M. air per occupant Tests 1 to 8	26.2	41.6	51.9
C. F. M. air per occupant. (Test No. 13, corridor doors open, fans not running)		32	
Ditto—test No. 14		26	
C. F. M. air per occupant (test 15, exhaust fan running)		54.5	
Air space per occupant, cu. ft.	735	715	2000
No. occupants	219	226	61
Contents, cu. ft.	159000	162000	162000
Floor area, sq. ft.	15900	16200	16200
Window area, sq. ft.	2100	2100	3500

C.F.M., whereas over 18,000 C.F.M. is required, leaving a deficiency of about 50% of air supply. Naturally the consequence is that the occupants cannot bear to have the exhaust fans run in cold weather.

It is very doubtful whether equal ventilation could ever be obtained on all floors with this system of ventilation—that is, exhaust fans on the top floor and all stairhall doors open—even if an adequate amount of radiation were provided to warm the air. The lower floors, especially the first and second, would undoubtedly be well ventilated, and would receive an ample amount of air at all times. The air in the floors near the neutral zone would be stagnant and the top, or fifth floor would very seldom receive anything except what might be termed "second hand" air, as its entire supply must come through the windows on one of the lower floors, pass over that floor and up the stairhall to the fifth floor, becoming more or less contaminated on the way. Under the conditions of this test, viz., a small number of employees on the top floor, this is not a very serious matter, but it certainly is not a very desirable condition in any case, as a ventilating system should provide each occupant of the space ventilated with an adequate supply of uncontaminated air.

The desirability of separate mechanical ventilation of toilets is especially great with a ventilating system of this character, as without it the suction effect of the fans and ventilators tends to draw toilet room air into the main room, whereas the air current should be in the opposite direction.

Conclusions of Tests.

It is evident from these tests, that:

A. In a building having five or more stories, a lively air movement can usually be obtained inward through the windows of the lower floors and outward through the windows of the upper floors.

B. There will necessarily be a neutral story at some point where the difference in pressure which causes the air movement, will equalize, and here the ventilation will be deficient.

C. If the windows are on all four sides of the building, and are operated properly, the distribution of fresh air may be so efficient as to permit of a material reduction in its volume.

D. The higher the building, the greater the difference in pressures causing air movement will be, provided the stairways, elevator shafts, etc., are open to the various floors.

E. The volume of air admitted in the lower stories must be so large in proportion to its contamination that it shall be suitable for ventilating purposes in the upper stories.

It is apparent that with such an

arrangement as described here, the manipulation of the windows in proper relation to the outside temperature and weather conditions is essential. The area of intake openings in any floor must be gauged in proper proportion to the relative position of that floor in the building, since, for instance, we find the first floor normally under a greater inward pressure than the second floor, and the third floor almost neutral.

It must be recognized that in cold weather, owing to the drafts caused by open windows, it is probable that the windows will be kept closed. If excess radiation is provided to care for the air used in creating ventilation, it is our belief that the entering air should be deflected through or over the radiation, or at least deflected so that the direct cold drafts cannot strike the occupants, and so that the rain and snow cannot enter.

In this connection, in considering the manipulation of windows in such a building as this for summer ventilation, where fly screens are provided, these must cover the entire window area, so that all of the windows may be opened from the top as well as from the bottom.

It is very important that the air conditions in a building of this character should be under the supervision of an intelligent person whose duty is to see that the windows and doors are open in such a manner as to allow the proper circulation of fresh air without causing objectionable drafts at any one point, and to see that the exhaust fans are operated when the building is occupied.

The studies made by the Chicago Commission on ventilation of the plants of the John Gorman Co. and the Paris Garter Co. were intended to develop in a measure, fair, comparative examples of the conditions of window ventilated buildings. The Gorman plant has windows on two sides only and comprises the fourth floor of a seven-story building. It is so arranged, apparently, that its position in the building has no special effect on it. The Paris Garter plant, on the other hand, is a five-story building; and the influence of the various floors on conditions in each other, is the most noticeable phenomenon observed. The following is a tabulation of some of the data.

No. Occupants	Space per Occup. cu. ft.	Ratio Window to floor	Ratio Window to C. C.	C. F. M. per Occupant	Temp. Deg. F.	Hum. per cent	Dust.	Bact.	Co. 2	Temp. Deg. F.	Wind. Veloc miles per hour.
					GORMAN						
110	650	1-11.5	1-120	93.2	70 deg.	43.5	32866	13.5	10.4	44.6deg.	9.7
					PARIS GARTER—3rd FLOOR						
219	735	1-77	1-77	26.2	69.75	28.7	4175	3.02	8.15	11.5	13.1

The amount of air handled per unit of time per occupant in the Gorman factory, it will be noted, was over three times that handled at the Paris Garter Factory. However, despite this, the latter shows superior air conditions. These are, of course, due to:

A. The fact that the Paris factory had no manufacturing processes under way which resulted in objectionable products of combustion of manufacture.

B. The fact that the latter had windows on all sides, so that wind movement could be utilized at all times.

C. The continuous air movement due to the exhaust fans, ventilators and the height of the Paris factory.

D. The fact that the Paris factory had fewer occupants per units, and much more sunshine.

In tests of such plants, having no particular control of window manipulation, our observations must be

understood as applying to the specific time of test only and not to all weather conditions. The conditions prevailing, however, at the time of this test were a fair average for the heating season. Had the weather been colder at the Gorman plant, or had there been no breeze, very much less air would surely have been provided. Had the day been warmer when the Paris Garter plant was tested, doubtless much more air movement would have been in effect. Window ventilation as installed in these plants does not in either case insure a continuous, dependable, and satisfactory condition.

Use of Cast-Iron Returns in District Heating Work.

The accompanying views show a section of the installation of cast-iron return mains in the Saginaw (Mich.) central station steam heating system. Ths is one of the first localities in which cast-iron pipe has been used for such purposes and considerable interest attaches to its serviceability. There are 3748 lin. feet of cast-iron pipe installed as return mains and 3359 ft. of services. The mains vary in size from 6-in. down to 3 in. with 2-in. services, while the greater part of the main is 6 in. The main is of variator construction and is not insulated in any form.

6-IN. CAST-IRON RETURN MAIN AT SAGINAW, MICH.

TYPICAL 2-IN. SERVICE CONNECTION TO CAST-IRON RETURN MAIN, SAGINAW, MICH.

After three years' service the company states that the main shows no sign of corrosion. It seems that a greater part of the city of Saginaw was built upon land which was formerly a swamp. The result has been that in the Spring of the year there is abnormally high water and after it subsides several breaks have been found, although these were mostly confined to services which are constructed of 2-in. Universal cast-iron pipe in 6-ft. lengths. As a general rule, this pipe broke at the joint which was bolted together.

In the Spring of 1916 there was exceptionally high water in Saginaw and after it receded seven breaks were found in the return line, one in the main and six at the services. The return system was not valved off at that time and the company experienced great difficulty in finding these leaks. However, after weeks of testing and experimenting, city water was turned into the mains which at once showed up all the leaks.

The ony trouble experienced with the use of cast-iron pipe seems to lie in the condition of the ground which varies considerably throughout the year. The use of the 2-in. cast-iron pipe when installing services has been discontinued and service connections are now made of wrought-iron pipe. No change, however, has been made in the mains themselves.

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EVERYONE is aware of the fact that vast changes in the economic life of the nations at war are to follow the conclusion of peace. We are warned that we must gird ourselves for the coming commercial struggle. Each individual industry must take up the challenge and place itself in readiness to meet the new era.

What is the heating industry doing to put its house in order and what steps are necessary to that end? A possible answer is suggested by what has happened in the gas industry, amounting to nothing less than the amalgamation of the entire industry into one organization—the American Gas Association. This action, which has just been consummated, "is the final outcome of a growing conviction among executives in control of gas companies and gas appliance and apparatus manufacturers that the best interests of the business would be served with one big national gas organization representing all the various phases of the industry, in place of the present association."

It is worth while to note just what has been accomplished by this amalgamation. Among other things, "there is now adequate financial backing, widespread membership and well-co-ordinated undertakings—an organization which will be in a position to gather and disseminate . . . . accurate information on all matters relating to the industry. It will also establish a closer co-operation between companies and manufacturers . . . . and afford opportunity for the solving of the many particular problems of the latter."

As to the various branches there are provisions for two classes of membership—company membership and active individual membership. The association is also divided into five sections: accounting, commercial, manufacturers, natural gas, and technical. Individuals will have the privilege of joining any one or more of the five sections. The dues are arranged to enable any individual to take an active part in any one or all of the sections, at an expense which will not be prohibitive.

At the present time the heating industry is confronted with such important projects as the establishment of a testing laboratory and the furtherance, in a highly practical way, of fuel conservation. Either one of these movements, if successfully carried out, may establish the pre-eminence of American heating practice. Has the time come, then, to go after these objects in a big way, in a way that will represent the best thought and enlist the combined practical support of all the interests involved—manufacturer, contractor and engineer?

IT is a significant thing that the manufacturers and heating contractors, together with the plumbers, represented by their national associations, have just taken what amounts to the first step in the history of the allied organizations towards unity. The "Building Bigger Business" campaign is a great co-operative movement. Is there any reason why the close relations thus established should not be made permanent?

NATIONAL DISTRICT HEATING ASSOCIATION

President George W. Martin on The Outlook in The Central Station Heating Industry

As everyone connected with the heating industry knows, operating companies have been facing extraordinary conditions of increased labor and fuel costs and have been forced to appeal to the Public Service Commissions of the various States for relief. It is encouraging to report that the Commissions have, I believe, in every case, granted some relief and have at least been convinced that district heating companies are entitled to consideration in the matter of a fair return for the service necessary for the health and comfort of the customers.

As I have already written to the members of the National District Heating Association, the situation in some respects has its advantages. The member companies in the past have been seemingly diffident in appealing to the Public Service Commissions for advances in rates. The high operating costs have left no other course open, however. Doubtless before the war's end several further advances in rates will have to be made, and with the Commission falling in with the views of the member companies, as they now seem to be doing, the burden of low rates will no longer handicap the industry.

GEORGE W. MARTIN,
President, National District Heating Association.

The shortage of coal for domestic purposes has brought to our member companies a large number of applications for service and has undoubtedly convinced many doubters of the desirability of district heating service. When the companies are in a position to make extensions without prohibitive costs, I look for a large increase in the district heating business.

It may interest the readers of THE HEATING AND VENTILATING MAGAZINE to know what the standing committees of the Association are doing, especially in view of the fact that no regular convention will be held this year; in its place a meeting of the Executive Committee and Committee Chairmen will be held, probably at Cedar Point, Ohio, for two days, beginning July 8. A general invitation will probably be extended to such of our members as care to attend, but, as already indicated, no formal convention will be held.

Of the standing committees, perhaps an outline of the work of six will be of interest to your readers.

The Station Operating Committee will report boiler-room tests in several of the member companies plants. The question of feed-water treatment will also be discussed and a summary presented of what might have been accomplished during the past year in improving boiler-room operation.

The Underground Construction Committee has distributed questionnaires dealing largely with practice in building manholes and expects to have considerable information regarding this feature of construction.

The Meter Committee is attempting to establish by test the actual capacity of each size of the most prominent types of steam traps. In addition to the work on traps, the Committee will as usual discuss any new developments in either condensation meters or steam flow meters.

The Advancement Committee, appointed at the last Convention, has been accumulat-

ing data relative to successful heating plants, including, among other things, the gross revenue of the detailed operating expenses of a successful combination property. The report will include the detailed study of the division of fuel in combination plants, describing and explaining various methods of this distribution. The important question of arranging rates as near as possible in accordance with the increase in operating costs will also receive attention.

The Educational Committee is giving considerable attention among other things to the matter of a standard rule for determining the proper amount of radiation for a building. One of the chief difficulties in making a standard rule for this purpose is that different authorities differ widely on heating losses through various kinds of construction material, but it is hoped some rule may be adopted which will be satisfactory at least to all our member companies, so that comparative data submitted may be compared on the same basis.

The Accounting Committee is preparing a report on standard system of accounts for district heating companies, which should be of great value to the member companies of our Association.

Another matter which is receiving attention is a suggested contract for hot-water district heating utilities, submitted to the Indiana Public Service Commission by the Bureau of Standards at Washington, D. C. A conference was held recently at Indianapolis at which representatives of thirteen member companies were present. After considerable discussion a committee was appointed to submit a report to the Educational Committee of our Association, which will in turn transmit a report to the Bureau of Standards.

The foregoing outline will, I think, indicate that the Association is living up to its reputation for active committee work and, in view of the fact that no convention is to be held this year, it is hoped that the committee reports will be of even greater value than those of the last year.

GEORGE W. MARTIN,
President, National District Heating Association.

Modern Practice in Vapor Heating

II

I.—THE ADSCO SYSTEM

EDITOR'S NOTE—*For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or thermograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.*

The first special system to be considered in this series is the "Adsco" system of atmospheric steam heating which has been developed and perfected by the American District Steam Co., of North Tonawanda, N. Y. This system was one of the first of the many so-called "vapor" systems to be evolved and as such has had the ample opportunity of a long period of years to be perfected.

REQUIREMENTS

Among some of the features which this system requires for its successful operation may be mentioned

A special reducing valve where district heating is used.

A special damper regulator where a boiler plant furnishes the steam supply.

Special gauges for registering in ounces instead of pounds.

An air-separating receiver for district heating connection.

An air vent line in one or more locations run through the roof.

A special safety valve (desirable) set to blow at 15 oz.

A special graduated control valve on each radiator.

The control valve must suit the size of radiator upon which it is installed otherwise proper control will not be secured.

As only 80% of the radiator surface is used for condensing steam the radiator surface must be increased 20% above that actually required to heat the building.

Hot water radiation must be used.

Indirect, direct-indirect, and hot blast radiation must not be connected to this system but should be piped according to usual standard methods.

TYPICAL SYSTEMS.

The piping system as designed to suit central heating conditions is shown in the typical layout given in Fig. 1 and the connections where a boiler is used on the premises is given in Fig. 2. The operation of the system is briefly outlined in the following description, the steam being supplied either from a common steam boiler or from district street mains through a special reducing valve.

6-in. low pressure main would be supplied by a 4-in. street connection and 4-in., or 4 x 6-in., reducing valve. The schedule of sizes recommended for 2 to 15 lbs. street pressure is as follows:

Sq. Ft. of Radiation	Size of Reducing Valve in. Diam.
0 to 200	1 x 1½
200 to 300	1¼ x 2
300 to 600	1½ x 2½
600 to 900	2 x 3
900 to 1400	2½ x 3½
1400 to 2200	3 x 4
2200 to 2800	3 x 5
2800 to 3600	4 x 5
3600 to 6000	4 x 6
6000 to 8500	5 x 7
8500 to 11,000	5 x 8

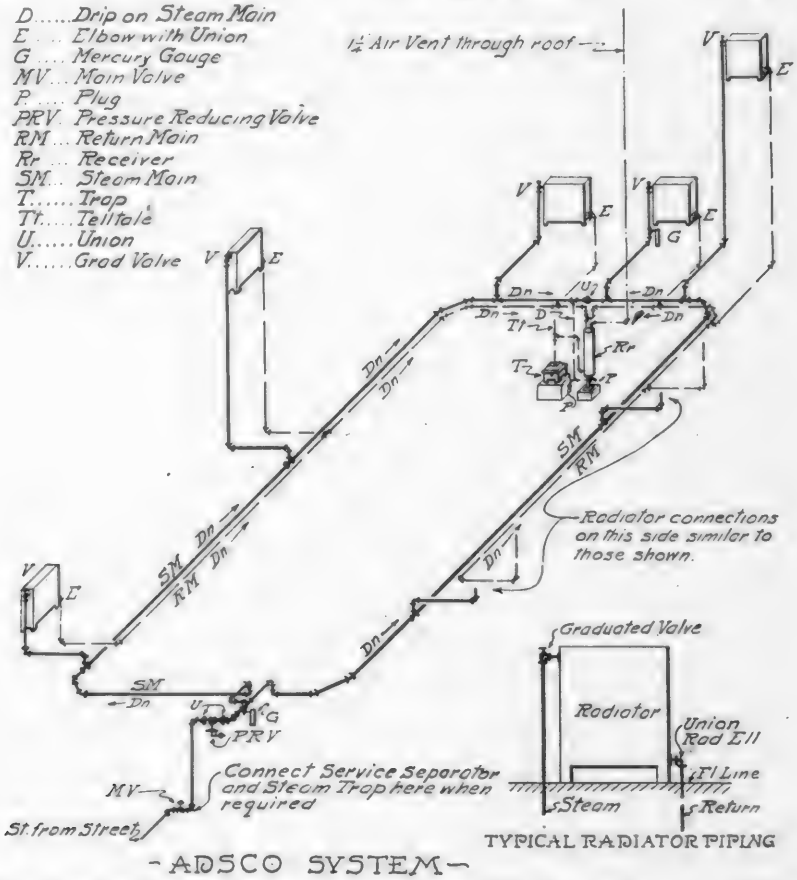


FIG. 1.—TYPICAL LAYOUT OF ADSCO SYSTEM TO SUIT CENTRAL HEATING CONDITIONS.

The steam when coming from the street is usually supplied at a pressure carrying from 2 to 10 lbs. and the special reducing valve is arranged to reduce and maintain on the system a pressure sufficient to give 5 oz. at the radiator valves. The sizes of reducing valve recommended are two pipe sizes less than the diameter of the low-pressure main; thus, a building requiring a

Straight valves with both inlet and outlet of the small size can also be used if desired.

If a steam boiler is to be used its load will only be 80% of the total radiation plus the steam main loss (not over 10%) mak-

ing the total required boiler capacity 90% of the total radiation; to control the boiler pressure a special regulator is used, this being illustrated in Fig. 3. It consists of a weighted float which rises on the surface of the water inside of the vented regulator. This float is connected to a lever operating the draft and check dampers. The creation of any pressure in the boiler backs the water down to 11 oz. if desired; its tapping is 1¼-in. size.

To accurately register the small amounts of pressure generated either the water gauge illustrated in Fig. 4 or the mercury gauge shown in Fig. 5 may be used. The water gauge is generally used on district heating systems but the mercury gauge may be applied to either.

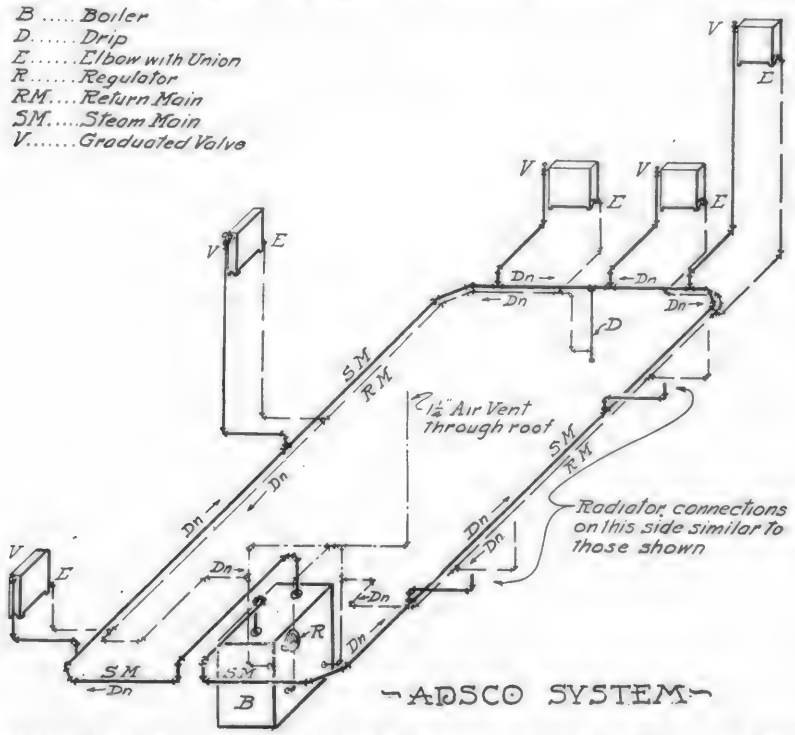


FIG. 2—ARRANGEMENT OF ADSCO SYSTEM WHERE BOILER IS USED ON PREMISES.

into the regulator and raises its water line, thus operating the float. The safety valve used on the boiler is set to relieve, at 15 oz. pressure but can readily be adjusted

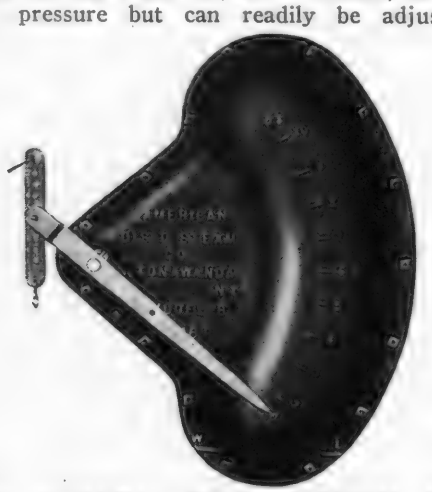


FIG. 3—SPECIAL BOILER PRESSURE REGULATOR.

The steam main in the basement should be arranged so as to secure the best circulation and with the minimum drop in pressure, drips being located where required either drained back to the boiler through a separate line or connected into the return line through 30-in. water seals. In all changes of direction on the main, bends, long sweep or 45° fittings should be used; pipe should be well reamed and clear; in fact everything should be done to promote the flow of steam with as little loss of pressure as possible and the size of the steam main should at no point be decreased below 1½ in.

The steam is carried in the steam main up to a point within four feet of the graduated radiator valve; at this point the radiator branch is reduced to ¾-in. in size as *all* radiator valves have ¾-in. thread. The interior construction of the valve is illustrated in Fig. 5 and it is one of the most important factors of the system. As designed it is

made to supply a given radiator with 80% of the amount of steam it can condense under ordinary operating conditions and with 5 oz. of steam pressure on the supply pipe to the valve; the proper size of radiator is stamped on the valve top and the valves are made with stampings in multiples of 5 from 10 sq. ft. to 200 sq. ft.; for this reason the size of the radiator must always be specified in ordering valves.

The radiators used are common cast-iron surface of water pattern tapped ¾-in. top and bottom opposite ends. No air valves are used and the return connection consists of simply a union radiator ell which is connected into the return line.

The return lines are under no pressure

FIG. 4—WATER GAUGE. FIG. 5—MERCURY GAUGE.

whatsoever, and serve to convey the water of condensation, together with the air, back to the point where the air separation takes place. In systems supplied from a street main and provided with a condensation meter a receiver is used, this being illustrated in Fig. 6. Such receivers have a minimum water depth of 30-in. and the outlet pipe to the meter carried up to a height 8-in. below the top. In Fig. 6, A indicates air vent pipe; B, return lines and C the outlet to the meter. The diameter of these receivers is recommended to be as follows:

Radiation. Sq. Ft.	Diameter of Receiver In.
600	5
1200	6
2000	8
6000	10
12000	12
20000	16

The air pipe is usually made 1¼-in. which is plenty large enough for any ordinary size system; more vents may be used on larger

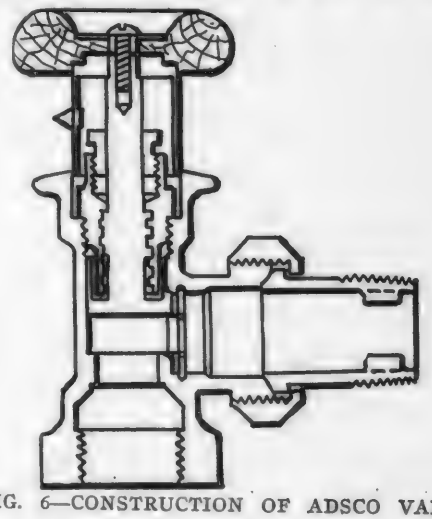


FIG. 6—CONSTRUCTION OF ADSCO VALVE.

systems and with a boiler supply no receiver is used. The air lines should be run at least 12 to 15 ft. above the water-line, terminating outside the building wall or carried up through the roof. The return either passes through the condensation meter or (in a boiler plant) drops down into the

FIG 7.—PIPE RECEIVER.

boiler by gravity. In both cases the return line is vented to the atmosphere and carries no pressure; it is not even necessary to cover this line unless thought desirable.

METHOD OF OPERATION

Steam finds its way through the steam main and branches up to the radiator valves which are turned on to the desired degree, a three-quarter turn serving to open or close the valve completely. The valve is designed so that the steam coming into the radiator through the valve, with 5 oz. pressure back of the valve, enters with just sufficient velocity to fill the radiator to the degree registered by the valve dial. If this is set at, say, ⅓ then the steam fills ⅓ of 80% of the radiator. Owing to the fact that steam is lighter than air it is usually the top portion of the radiator which is heated, the return and air which the steam displaces finding their way down and out through the return ell. The air and condensation then flow back through the return line to the point of air separation where the air leaves the system through the open vent pipe while the returns go to the meter or back to the boiler by gravity.

LEGAL DECISIONS

Surcharge for Heating Service On Account of Increased Cost of Fuel.

The Brownville Electric Light & Power Company petitioned the Indiana Public Service Commission for authority to add a temporary surcharge to all bills for hot-water heating service. It appeared that while the electric department of the company's business was profitable, its rate of 12 cents per square foot of radiation per season is not sufficient to return to the company on its hot-water heating service, operating expenses and taxes under the abnormal prices existing for coal and the advances in the cost of labor, supplies, and other materials, all of which are attributable to a war era and are looked upon as being temporary. The petitioner's rate for hot-water heating is the lowest for such service in the State of Indiana. It has been made possible by the petitioner's ability to obtain coal at $1 a ton; and there has been an advance of 50 per cent in its coal contract. The city protested to the surcharge on account of the increased cost of heat furnished to its schools and other public buildings, and alleged that the cost of such service in public buildings would be greater than would be the cost of heating these buildings by individual plants; and that, on the other hand, the cost of installing individual plants at this time is extraordinarily high. The Commission did not consider this a valid objection to the proposed relief and approved a surcharge of 5½ cents per square foot of radiation for the heating season of 1917-18. At the same time the Indiana Commission made the following orders allowing surcharges for heating service: Princeton Light & Power Co. Hot-water heating; surcharge of 17 cents per square foot of radiation. Central Indiana Lighting Co. Hot-water heating; surcharge of 7 cents. Interstate Public Service Co. Hot-water heating; surcharge of 5 cents and 7 cents. Indiana R. & Light Co. Steam heating; surcharge of 30% of bill allowed.

Apportionment of Expenses Between Electric and Heating Departments.

In a rate investigation the Colorado Commission holds that the apportionment of operating expenses as between the electric and steam heating departments of a public utility on the basis of coal consumption in some cases and investment in others was held proper. An apportionment of commercial expense to the gas, electric and steam heating departments of a utility on the basis of the number of consumers in these departments, was held proper. An apportionment of valuation expense, accidents and damages, legal expense in connection with damages, interest on consumers' deposits, rent, and county and State taxes between these three departments on the basis of gross revenue was held proper; and an apportionment of inventory and appraisal costs between the departments on the basis of their appraised value, and of the cost of conducting rate hearings on the basis of gross revenue, were held proper. Re Colorado Springs Light, Heat & Power Co.

Combined Electric and Heating Plant—Cost of Coal and Heating Rates.

The Illinois Public Utilities Commission holds that a utility that has developed a heating service through the operation for many years of a combined electric and heating plant should not be relieved of its obligation to furnish heating service upon building a separate electric plant to effect economies in the generation of electricity, although the heating department has since been operated at a loss and the distribution system is in need of extensive repairs. The heating service should be continued at a rate that will return sufficient revenues to meet reasonable operating expenses, plus a reasonable depreciation and a reasonable return on the additional investment necessary to restore

the plant to its former capacity and a return on the junk value of the existing plant. The change in the method of operating which has benefited the electric department and has not been shared by the consumers should be reflected to some extent by reductions in the earnings to which the heat department might otherwise be entitled. The utility, Alton Gas & Electric Company, operates its combined electric and heating plant merely because of the existing heating business, and procures most of its current from other sources. The Commission holds that the company should credit the heating department for current generated at the combined plant on a basis of cost rather than on a basis of worth, by taking the average of the actual cost of production at the heating plant with the cost of electricity procured elsewhere, instead of the average cost of procuring the current elsewhere. Owing to the increasing price of coal, the coal prices during the season 1915-16 were taken as the basis for determining steam heating rates with provision made for a variable rate differential, both up and down, predicated on the future average cost of coal to the company.

Discrimination in Rates.

The Ohio Supreme Court holds that municipalities of the State are authorized to establish, maintain and operate lighting, power and heating plants and furnish the municipality and the inhabitants thereof with light, power and heat. The powers thus conferred are proprietary in their character, and in the management and operation of such plant municipal officials are permitted wide discretion. Courts are without authority to interfere therewith upon complaint merely that the capacity of the plant is overtaxed and streets of the municipality are insufficiently lighted by means of furnishing current to private consumers, and that the rates charged for current are inadequate to meet the cost of production and transmission thereof. But where the council of any such municipality fails to adopt and use a system or schedule of rates for current furnished to private consumers as contemplated by section 3616 Ohio General Code, but leaves the matter of rates to the administrative officers of the municipality, who arbitrarily fix and determine the rates in each case, and in so doing unjustly discriminate between citizens in the matter of rates and service, such action constitutes an abuse of corporate power which may be restrained by the court upon suit instituted by the city solicitor, or by a taxpayer if the city solicitor refuses upon written request to institute suit,—Butler v. Karb, 117 N. E., 953.

Steam Heating—Values, Return and Minimum Bills.

The Illinois Public Utilities Commission holds, Kennedy v. De Kalb-Sycamore Electric Co., that the fair present value of property used and useful in rendering public service rather than the cost of such property must be taken as the rate-making value. In apportioning the value of property used in the steam-heating service of a utility furnishing electricity and steam heat in two cities and interurban railway service between these two cities, consideration must be given to the saving effected by the utility's present method of operation in generating all the electricity in one city, rather than operating combined electric and steam-heating plants in each city as formerly, thus making available large quantities of exhaust steam for heating purposes in the city served by the combined plant, since the entire advantage of this mode of operation should not be enjoyed solely by the heat consumers in the latter city. A return of 7% was allowed as a fair return on the fair value of a steam-heating plant. It was held that a minimum bill should embrace, in addition to the fixed consumer expense, the average cost of the commodity consumed under the minimum quantity. The minimum bill was fixed at $3 months of heating.

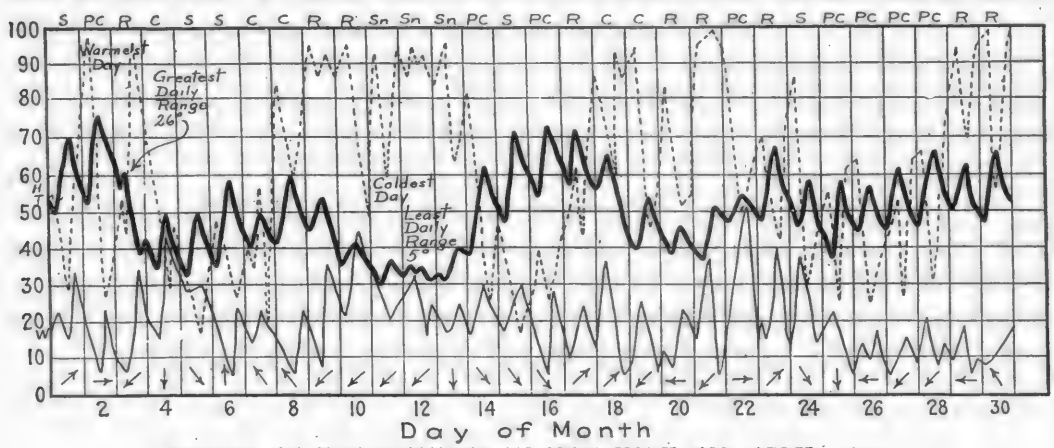
Meter Rates Substituted for Flat Rates.

The Wisconsin Railroad Commission has granted an application of the Milwaukee Electric Railway & Light Company for authority to discontinue flat rates for heating service. It considered that complete metering of the heating system is the only means of eliminating a condition of actual discrimination among the customers of the company.

The Illinois Public Utilities Commission has permitted the Central Illinois Light Company to withdraw a flat rate for steam heating and to put all consumers on a meter rate schedule where it appeared that discrimination as to the amount of the rates existed in favor of the flat-rate consumer. It considers that prior to the substitution of meter rates for flat rates for steam heating in any case, sufficient notice should be given to the flat-rate consumers to permit them to install private heating plants should they desire to do so.

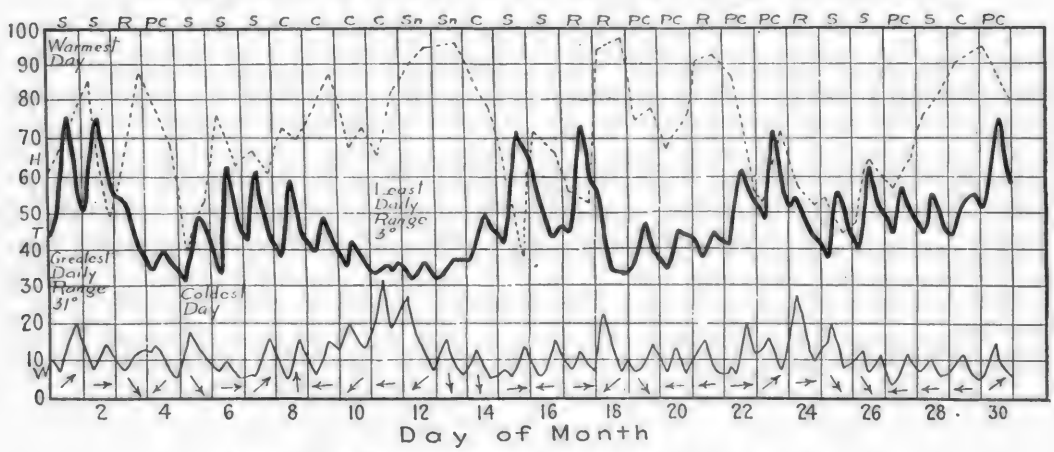
The Weather for April, 1918

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	76	76	74	76	81
Date of highest temperature	2	1	2	16	16
Lowest temperature, degrees F.	30	31	27	29	30
Date of lowest temperature	11	5	10	9	10
Greatest daily range, degrees F.	26	31	30	24	30
Date of greatest daily range	3	1	15	22	2
Least daily range, degrees F.	5	3	5	4	4
Date of least daily range	12	11	20	11	25
Mean temperature for month, degrees F.	49.8	48	49	44	51.2
Normal mean temp. for month, degrees F.	48.1	45.3	51	45.9	56.1
Total rainfall, in.	3.78	3.08	2.27	3.41	7.09
Total snowfall, in.	2.60	4.2	7.1	Trace	Trace
Normal precipitation, this month, in.	3.30	3.55	2.9	2.88	3.52
Total wind movement, miles	11142	7700	9169	10474	10144
Average hourly wind velocity, miles	15.5	10.7	12.7	14.5	14.1
Prevailing direction of wind	N. E.	E.	N. W.	N. E.	N. E.
Number of clear days	5	11	4	9	7
Number of partly cloudy days	10	9	3	7	12
Number of cloudy days	15	10	23	14	11
Number of days on which rain fell	7	6	15	18	15
Number of days on which snow fell	3	2	2	—	—
Snow on ground at end of month, in.	None	None	None	None	None

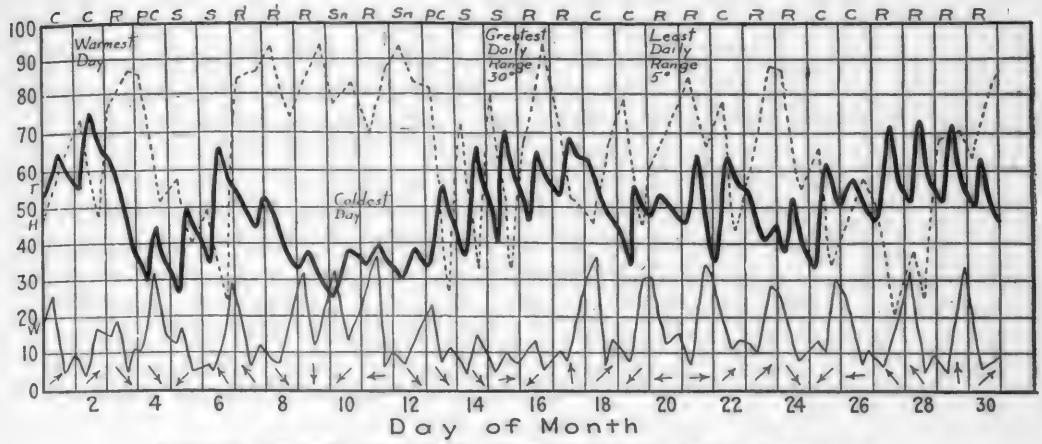

S PC R C S S C C R R Sn Sn Sn PC S PC R C C R R PC R S PC PC PC PC R R
Warmest Day
Greatest Daily Range 26°
Coldest Day
Least Daily Range 5°
H T W
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN NEW YORK FOR APRIL, 1918.

(Hourly Observations of the Relative Humidity Are Recorded on This Chart.)


S S R PC S S S C C C C Sn Sn C S S R R PC PC R PC PC R S S PC S C PC
Warmest Day
Least Daily Range 3°
Greatest Daily Range 31°
Coldest Day
H T W
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN BOSTON FOR APRIL, 1918.


C C R PC S S R R R Sn R Sn PC S S R R C C R R C R R C C R R R R
Warmest Day
Greatest Daily Range 30°
Least Daily Range 5°
Coldest Day
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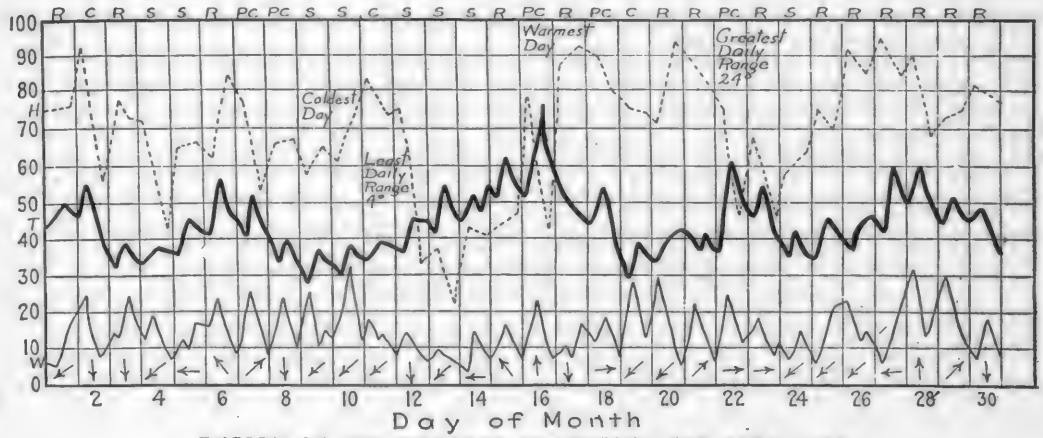
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR APRIL, 1918.


R C R S S R PC PC S S C S S S R PC R PC C R R PC R S R R R R R R
Warmest Day
Greatest Daily Range 24°
Coldest Day
Least Daily Range 4°
H
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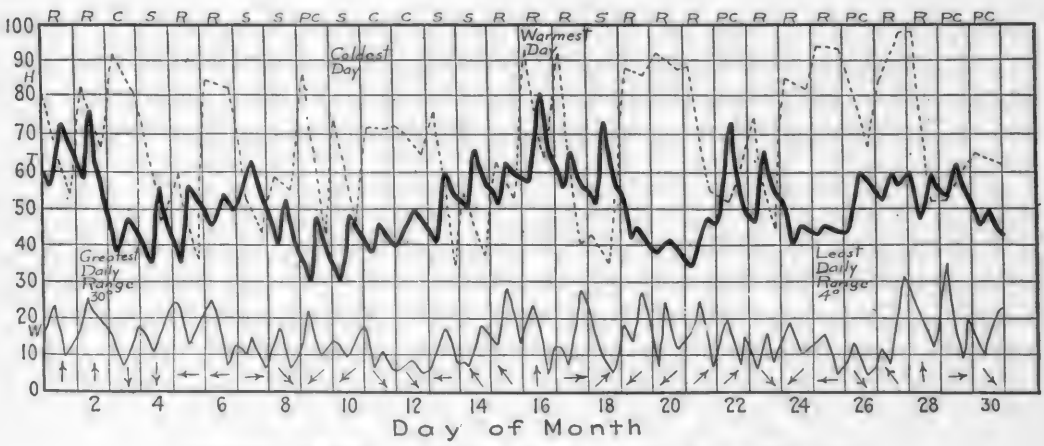
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR APRIL, 1918.


R R C S R R S S PC S C C S S R R R S R R R PC R R R PC R R PC PC
Coldest Day
Warmest Day
Greatest Daily Range 30°
Least Daily Range 4°
H
T
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100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR APRIL, 1918.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

The War and the Heating Engineer

Coal Week.

"Coal week," from June 3 to 8, was widely observed in accordance with the suggestion of United States Fuel Administrator Garfield. During this week an intensive and specific drive was made on the early ordering of coal. The fuel administration has announced that the early ordering campaign will be vigorously pushed even though dealers are not able at the present time to get sufficient coal to fill all the orders. By accumulating a large volume of orders in the hands of the dealers it is expected that there will be demonstrated to every agency concerned in the distribution of coal, the universality and urgency of the demand.

Fuel Administration's Campaign for Fuel Conservation in Power Plants.

Thomas R. Brown of Pittsburgh, Pa., has been appointed administrative engineer for the United States Fuel Administration for the Pittsburgh district, and C. P. Billings has been named as special staff assistant. This is the first step of a plan inaugurated by the fuel administration for fuel conservation in power plants.

This plan is the result of conferences with the Federal Fuel Administrators and their committees for the group of States which together consume about 70% of all the coal used in the United States, exclusive of railroads. The plan has received the indorsement of the fuel administrators of all these States, as well as approval of the United States Bureau of Mines and a committee representing the Engineering Council of the four national engineering societies.

The slogan of the campaign is "Maximum production with minimum waste."

In laying the foundations for the organization it has been anticipated that this work should become a permanent service of the government.

Ten to twenty per cent—that is, from twenty-five to fifty million tons of coal per year—can be saved by the correct operation of steam power plants, using their present equipment, in the industries, in office buildings, hotels, apartment houses, etc.

It is considered most important that

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DELIVERED TO YOUR HOME

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TO THE LOCAL POSTMASTER:—Kindly have letter-carrier deliver to me on _____ (Date) for which I will pay on delivery:

_____ (State number wanted) $5. U. S. WAR-SAVINGS STAMPS at $_____ (See prices below) each

_____ (State number wanted) 25c. U. S. THRIFT STAMPS at 25c. each.

Name _____

Address _____

W.S.S.
WAR SAVINGS STAMPS
ISSUED BY THE
UNITED STATES
GOVERNMENT

W. S. S. COST DURING 1918

April	$4.15	July	$4.18	Oct.	$4.21
May	4.16	Aug.	4.19	Nov.	4.22
June	4.17	Sept.	4.20	Dec.	4 23

W. S. S. WORTH $5.00 JANUARY 1, 1923

all existing fuel-conservation committees, committees of chambers of commerce and national defense, manufacturers' associations, and other bodies be continued in full force, and that the work of such organizations be consolidated with the national program, which comprises certain fundamentals, as follows:

1. Personal inspection of every power plant in the country.

2. Classification and rating of every power plant, based upon the thoroughness with which owner of said plant conforms to recommendation.

3. Responsibility of rating the plants will fall upon an engineer in each district, the rating to be based upon reports of inspectors, who will not express opinions, but will collect definite information. The State fuel administrator, in his judgment, may entirely or partially shut off the consumption of coal to any needlessly wasteful plant in his territory.

4. Inspectors are to be furnished from one or more of the following sources: (a) Inspectors of the steam-boiler insurance companies; (*b*) State factory inspectors; (*c*) engineering students from technical colleges; (*d*) volunteers.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in class 1, 2, 3 or 4.

SAVINGS FIGURED ON PRESENT EQUIPMENT

The ratings will be based upon existing equipment. The difficulty, delay, and expense involved in the installation at this time of improved power equipment is fully recognized, but experience has proved that 10 to 20% of fuel now used in power plants can be saved by improvements in operation alone.

In advance of the first inspection a questionnaire will be sent to every power plant in each district, with notice to the owner that within 60 or 90 days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will tend to prepare the minds of plant owners for what will follow. It will operate to induce proper care in furnishing information and will also tend to produce a desire to improve their plants, if necessary, so that they may be rated in a high class by the time the inspector calls.

It is recommended that a board of competent engineers be attached to the conservation committee in each State; also a corps of lecturers to arouse public interest and disseminate engineering information.

The Fuel Administration has prepared a 50-minute film of moving pictures showing good and bad operation in the steam-boiler plant, methods of testing boilers, fuels, etc. These pictures will be available for each State in connection with its educational propaganda.

The administration is also preparing a series of official bulletins on engineering phases of steam and fuel economics. Some of these are now ready for printing. They will include:

1. Boiler and Furnace Testing.
2. Flue Gas Analysis.
3. Saving Steam in Heating Systems.
4. Boiler-room Accounting Systems.
5. Saving Steam and Fuel in Industrial
6. Burning Fine Sizes of Anthracite.
7. Boiler Water Treatment.
8. Oil Burning.
9. Stoker Operation.

In addition to this service, a list of competent engineers has been prepared in Washington for each State and is available for use of each local administration. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.

Thrift Stamp Day to Be a Monthly Event.

Thrift Stamp day in the U. S. A. has come to stay, according to an announcement of the War Savings Stamp Committee. The results of the first Thrift Stamp day were so satisfactory that the National committee for Greater New York has decided to hereafter set aside every first day of each month as Thrift Stamp day.

June 14 Flag Day.

On June 14, which is Flag Day, steps are being taken by the National Americanization Committee to have a flag-raising in every industrial plant in the country. The special object sought this year is the promotion of patriotism in the plant, with the slogans of "every man on the job every day," "no needless days off," "no sabotage," "no strike on the job" and "no restricting of production by the workers." Employers are especially urged to

help in the development of the loyal spirit among native and foreign-born employees by making them realize that America is the land of the square deal and then giving them a square deal in their plants. To this end employers are asked to take steps at once to give their employees who do not speak English an opportunity to learn the language.

A possible 650,000,000 bushels, the greatest winter wheat crop since the record-breaking yield of 1915, together with a probable increase of 15% in the acreage of spring wheat, is the forecast made in a report on the condition of winter wheat issued by the Chamber of Commerce of the United States through its committee on statistics and standards.

War Resolutions of United States Chamber of Commerce.

Among the resolutions adopted at the recent meeting of the United States Chamber of Commerce in Chicago was one in favor of universal military training, one urging careful scrutiny before the control of any industry is assumed by the government, one urging liberal treatment on the part of State and local authorities of public utilities, and one discouraging new business undertakings that do not contribute directly or indirectly toward the winning of the war.

Harry A. Wheeler is the newly-elected president of the United States Chamber of Commerce.

Heating Men in Military Service.

Allen Blomfeldt, of Blomfeldt & Rapp Co., Chicago, is attached to Company A, Twelfth Regiment, stationed at Camp Paul Jones, Great Lakes Training Station.

R. B. Hedlund, of the boiler department of the Illinois Malleable Iron Co., Chicago, has enlisted in the Navy.

First Lieutenant Earl T. Williams, of the 301st Field Artillery, stationed at Camp Devens, Ayer, Mass., was killed May 6, at Northampton, Mass., by the falling branch of a tree. Lieutenant Williams was vice-president of the J. H. Williams & Co., Brooklyn, N. Y., being formerly in charge of the manufacture of the company's line of chain wrenches at its Buffalo plant. He was graduated from Yale in 1910 and was formerly a member of Squadron A, New York.

Major R. A. Widdicombe, of Chicago, is now constructing quartermaster of Chemical Plant No. 4, Saltville, Va.

W. K. Abernethy, formerly manager of the Minneapolis office of the Central Station Steam Co., Detroit, Mich., has enlisted in the aviation corps and is at present stationed at Rich Field, Waco, Texas.

Archer A. Landon, vice-president of the American Radiator Co., in charge of the company's plant in Buffalo, has been appointed by Director John D. Ryan, director of the production division of the Aircraft Board.

D. Rait Richardson, president of the National Warm Air Heating and Ventilating Association, has resigned his office to enter the government service in the Construction Division of the Ordnance Department. Mr. Richardson will be located for the present in Washington. The annual convention of the National Warm Air Heating and Ventilating Association will be held in June so that Mr. Richardson's retirement comes almost at the end of his present term.

Early Coal-Buying Campaign in New Jersey.

Action to insure the early purchase and storage of coal and coke in New Jersey, for necessary domestic requirements, has been taken by Richard C. Jenkinson, Federal fuel administrator for the State, by the issuance of the following rules and regulations which are now in effect:

1. Until further notice no domestic consumer of coal or coke shall purchase, receive or otherwise take possession of more coal or coke than is required for his actual and necessary requirements prior to March 31, 1919. If such consumer already has a quantity of coal he shall receive only such additional amount as shall make up his actual and necessary requirements prior to that date.

2. No person, firm, association or corporation, whether acting alone or in con-

junction with others, shall, directly or indirectly provide any domestic consumer of coal or coke with more coal or coke before March 31, 1919, than is necessary with the amount already on hand, to meet the actual and necessary requiremnts of such consumer prior to that date.

3. On and after the date hereof, no person, firm, association or corporation shall sell or deliver coal to a domestic consumer who does not first furnish to the person selling or delivering such coal, a statement which the consumer declares in writing to be true, and which specifies (1) the amount of coal consumer has on hand. (2) the amount of coal he has on order and the name of the person from whom ordered; (3) the amount of coal used by him in the twelve months ending March 31, 1918, and (4) the amount of coal needed to meet the actual and necessary requirements prior to March 31, 1919.

4. Until further notice no retail dealer shall, unless authorized by the State Fuel Administrator, deliver or cause to be delivered to any domestic consumer more than one third of his normal annual requirements of anthracite until each domestic consumer who has placed his order with said dealer and is wililng to receive delivery of the same, has received one-third of his normal annual requirements for the year ending March 31, 1919; nor shall the dealer deliver more than two thirds of any domestic consumer's requirements until each domestic consumer, who has placed his order and is willing to receive delivery, has received two thirds of his requiremnts; provided, however, that requirements of six tons or less may be filled in full.

5. Car load or barge load lots shall not be delivered to a single domestic consumer, or to a group of consumers, except with the permission of the State Fuel Administrator.

6. Dealers may be required at any time to file with the local Fuel Administrator a statement containing the names and addresses of consumers to whom deliveries have been made and the quantity delivered to each.

ANY DEALER OR CUSTOMER WHO VIOLATES THE FOREGOING REGULATIONS WILL BE SUBJECT TO THE LEVER ACT, WHICH IMPOSES PENALTIES OF $5,000 FINE OR TWO YEARS' IMPRISONMENT, OR BOTH.

Accompanying the order is a blank form, copies of which are to be filled out by the individual consumers, giving an accurate statement of their present supply, last winter's requiremnts, etc.

CORRESPONDENCE

Steam Heating Problems.

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you please answer the following questions:

Question No. 1: If 50 lbs. of steam are produced at 80 lbs. gage pressure and reduced to 5 lbs. gage pressure, how much steam do you have and is there any reduction or increase in the moisture?

Question No. 2: If previously a room was kept at around 80° F. and now it is reduced to 65°, what saving is there in coal in a year? Coal to have 12,000 B.T.U. Plant to room, 100 ft. Steam generated at 80 lbs. Reduced to 5 lbs. in heating system.

Question No. 3: If I have a 6-in. pipe and I have steam pressure on it of 80 lbs., how much steam is flowing through it?

Question No. 4: If I measure the returns from a building can I tell how much steam was put into the building or are there losses? If I know how much was put in and measure returns does that give me the efficiency of the system? How can that be increased?

Utica, N. Y. C. A. C., JR.

In reply to Question No. 1 we would say that there will be no difference in the quantity (weight) of steam because of a reduction in pressure. No steam is taken away during such a reduction and no steam is added. It is true that the *density* of the steam (pounds per cubic foot) is made less due to the expansion of the gas at the lower pressure and it is also true that the volume will be greater, but the quantity (by weight) remains the same.

There is likely to be less moisture in the steam at the reduced pressure for if the steam at the higher pressure is saturated (as it normally is) when reduced to the lower pressure a certain number of heat units are released which go to slightly superheat the steam at the lower pressure and to make up radiation losses in the valve and low-pressure piping. It is quite probable that the drip from a low-pressure main fed by a reducing valve would be a little less than the drip from a similar main fed directly from a low-pressure heating boiler; the difference, however, would not amount to a great deal.

In regard to Question No. 2, a room kept at 80° F (assuming zero outside as minimum temperature) would require roughly 80/70 of the radiation necessary to maintain 70°

and if reduced to 65° would require roughly 65/70 of the radiation necessary to keep it at 70°. We say "roughly" because the radiator at 80° room temperature will possess slightly less efficiency per square foot than when the room is at 65°.

Concerning the amount of coal saved we cannot even guess without knowing the amount of heating surface in the room, number of days heated, etc. The *percentage* of saving in the room can, however, be determined as follows:

Present temperature of room.....80° F.
Average winter temperature.....35° F.

Temperature difference maintained....45° F.
Proposed reduction of temperature to..65° F.
Average winter temperature.....35° F.
Proposed temperature difference.....30° F.

Then 45° : 30° : : present coal : X
or 30/45 × present coal = X
or 2/3 of present coal = proposed coal
Saving in coal = present coal — X or
present coal — 2/3 present coal = 1/3, or
33 1/3% saving in room.

On the line run over from the plant the loss will not be reduced at all but (owing to no information being given as to the size of this line or its insulation) it is impossible to approximate this amount.

Question No. 3. The steam pressure in a pipe is no indication of the velocity of the steam flowing through it. If the end of the pipe were closed no steam at all would be flowing while if a steam engine or other apparatus were connected to the end of the line the flow might be almost anything as long as the pressure is maintained by a constant supply of steam being fed into the other end of the pipe.

Question No. 4. Many district heating companies measure their customers' steam consumption by metering their returns. Where automatic air valves are used there is doubtless some waste and loss which is not returned in the condensation; in a vacuum system there is practically no loss except through the leakage around the stem packing of the steam valves. In any case such losses are practically negligible.

If the quantity of steam supplied to a building is known so accurately that the returns can be measured and deducted therefrom, the difference would represent the *water* or *steam* loss in the building. This does not affect the *efficiency* of the heating as steam blown into a room in the form of vapor furnishes just as many heat units as when condensed in a radiator.

The only way the loss of steam on returns can be reduced is by re-packing valve stems to stop leakage and re-adjusting automatic air valves so as to shut tight when the steam strikes them. There is no particular object (from a heating standpoint) in the stoppage of such losses unless the cost of water is very high or the leakage becomes a nuisance.

The efficiency of a heating system is very close to 100%; that is, all the heat delivered by the steam into a heating system comes out in the form of heat either at the radiators or from the piping; the only loss likely to occur is in the heat carried back in the returns but even this is utilized if the returns are again fed into the boiler for re-evaporation.

Sizing Ducts and Flues.—Method No. 1 Questioned by Correspondent.

EDITOR HEATING AND VENTILATING MAGAZINE:

I noticed, in your April issue, the Data Sheet (No. 10-M) purporting to describe a method for designing duct systems, referred to as "Method No. 1" and which the author claims to have used; and I would hardly think any engineer who tries conscientiously to do the best work, would want to admit in print that he uses such guesswork methods.

The problem as stated is to deliver 1500 cu. ft. of air per minute from each of sixteen outlets. This is all the information we have, so we must make some assumptions. Now we cannot assume but one velocity condition, the others must be calculated from this assumption. For instance, we may assume a final velocity in each outlet of 400 ft. per minute in which case the velocity at the fan, and in all other portions of the system, must be calculated; or we may assume a velocity of 1000 ft. per minute at the fan in which case the final velocity must be calculated. The point I wish to bring out is that we cannot assume both. We cannot say we will use velocities ranging from 400 to 1000, as this writer has done, and expect satisfactory operation.

For this problem, if we assume a final velocity of 400 ft. and adjust our fan speed to get it, then the velocity at the fan will be about 815 ft. with a properly designed system. If we had assumed a velocity of 1000 ft. at the fan and had laid out the system correctly, the final velocity at the outlets *would not be* 400 ft. per minute, but about 485 ft. per minute. This means that if the trunk duct is cut down until a velocity of 1000 at the fan is obtained, the fan speed being adjusted to get this velocity, then the outlets, designed for 400 ft. velocity, will be too large, resulting in those near the fan

taking more than their share of the air and causing the ones farthest from the fan to suffer.

It may be argued that dampers can be placed in the near outlets to choke them down. This, of course, is true, but if we are going to guess our duct sizes, and then choke them down with dampers, why not guess the sizes directly instead of going through the formality of guessing the velocity and then figuring the sizes from this? When we figure radiation, we don't put in twice as much surface as is needed and say, "Oh, let them turn half the radiators off, if it gets too hot."

Now there is nothing mysterious about figuring ducts, and there is positively no excuse for the existence of such methods as those proposed in the article referred to. The flow of air in ducts follows the same well-known laws that all fluids follow, and it is either laziness, or ignorance of these laws, which makes a man use slip-shod, careless methods in his duct calculations. The correct method is not any longer or more complicated, when properly understood than the method proposed. I worked out the duct sizes for the problem given, in less than 10 minutes by reference to a single diagram, which I figured out several years ago, whereon the sizes of the ducts may be read off directly, with practically no computations. In fact, I have often, in the case of very long ducts, read the sizes off to an assistant as fast as he could put the figures down. Can any method be any quicker than this?

It seems so evident to me that it is incorrect to base duct sizes entirely on velocity that I believe with a little consideration, all other engineers would also see it. I ceratinly hope your magazine will lend its influence toward discouraging such practice, as such make-shift methods of design are much more prevalent in heating and ventilating than in any other branch of engineering.

Cleveland, Ohio. L. K.

The duct system in question was illustrated in THE HEATING AND VENTILATING MAGAZINE for April, 1918; on Standard Data Sheet No 10-M, and resulted in the following shedule of sizes:

Duct or Flue	Cu. Ft. per M.	Velocity Ft. M.	Area Sq. In.	Area Sq. Ft.
A	24,000	1000	3456	24.0
B	21,000	900	3360	23.3
C	18,000	850	3048	21.2
D	15,000	800	2700	18.7
E	9,000	600	2160	15.0
F	9,000	600	2160	15.0
G	6,000	500	1728	12.0
H	3,000	400	1080	7.5
J	6,000	750	1152	8.0
K-M-O-P-Q	1,500 (ea.)	400	540	3.75
L	4,500	600	1080	7.5
N	3,000	500	864	6.0

According to our correspondent the sizes as shown on his sketch submitted with his letter should be as follows:

Duct or Flue	Cu. Ft. per M.	Velocity Ft. M.	Area Sq. In.	Area Sq. Ft.
A	24,000	815	4248	29.5
B	21,000	800	3787	26.3
C	18,000	765	3384	23.5
D	15,000	714	3024	21.0
E	9,000	630	2059	14.3
F	9,000	630	2059	14.3
G	6,000	571	1512	10.5
H	3,000	465	929	6.45
J	6,000	571	1512	10.5
K-M-O-P-Q	1,500 (ea.)	400	540	3.75
L	4,500	529	1224	8.5
N	3,000	465	929	6.45

The main difference between the two appears to be that our correspondent increases his velocities at a slightly lower rate than that called for in the data sheet although what determines this rate is not given, unless it is the diagram to which he refers. If this diagram possesses the property of allowing a duct system to be sized "as fast as the figures can be put down" it is one that will be recognized as having great value for the designing engineer.

Our correspondent's letter was referred to the author of the data sheet in question and his reply follows:

The correspondent is wrong in his contention that duct systems sized on a proportional velocity basis running in graduated steps from the highest velocity at the fan outlet down to the lowest velocity at the farthest end of the system will not give results, for many systems so sized are giving the air required at the points desired which is all any system can do.

If the correspondent admits that air *can* be delivered from the system illustrated in the locations and quantities noted, then his own scheme falls to the ground as he proposes to deliver the same quantity of air to the same locations *but by using flues and ducts of larger areas* the increases varying up to almost 25% additional area at the fan. Why?

If the correspondent takes the position that the duct system as illustrated—or others designed in the same manner—will *not* deliver the air in the locations and quantities

desired it is useless to attempt to discuss the matter for there are too many systems in operation today all giving (as near as any ventilation system can give) the results desired.

The correspondent asserts that "we can not assume but one velocity condition and the others must be calculated from this assumption." Possibly so—to get a theoretically correct design in the system—but what is the use of being theoretically correct if it takes more galvanized iron? Good engineering consists of getting the *best* results with the *least* expenditure more than it does of being theoretically correct.

There *is* a weakness of the "assumed velocity" method which the critic, however, has not mentioned. This is the fact that the friction loss is likely to vary for every change in duct size and only an experienced designer can tell the approximate static pressure necessary to deliver the air in the quantity desired, and it is this pressure, together with the volume, which determines the size and speed of the fan. There are usually, however, so many variables on a duct system that great refinements in this direction are not desirable. A little experience along this line will usually enable one to come very close to actual results, especially when the velocities are always kept between the same limits.

It has never been claimed that a system designed in this manner is theoretically perfect, but only that it is practical and gives practical results. Of course, volume dampers are used with it and if correspondent has had any experience in ventilating work he uses volume dampers, too. It is indeed entirely impractical under the conditions of modern construction to design systems without such control, as the heating system is installed in the building and not the building built around the heating system.

The sizing of a flue and the sizing of a steam radiator is hardly comparable and it would have been much better if the sizing of a flue or duct (rather than the "outlet") were compared to sizing the steam pipe for a given radiator. In each case the device serves as an avenue through which a given quantity of a medium flows and every one will agree that there is considerable difference of opinion as to what the proper size of a steam pipe should be.

Would it not be desirable to have the correspondent submit full data of his method of figuring duct and flue sizes for presentation in the pages of the magazine, leaving it to the readers to use the systems which they find most practical and least laborious? And are "make shift methods of design more prevalent in heating and ventilating than in any other branch of engineering?"

Figuring Heat Losses.

EDITOR HEATING AND VENTILATING MAGAZINE:

We would appreciate some information on the following: On Standard Data Sheet No. 1 why is the heat loss greater through a brick wall plastered on the inside, than through a plain brick wall?

Is this the way you would figure a 6-in. tile and 2-in. concrete roof with paper, tar and gravel, top layer 25.2, one foot air space and lath and plastered ceiling, 43.4, $\frac{1}{252} + \frac{1}{434} = \frac{686}{108768}$ or 15.8 B.T.U. at 70°F.

Also in figuring radiation required, do you figure the actual size of the opening, or just the size of the glass?

Pittsburgh, Pa. J. A. L. & S. Co.

In regard to the question on plastered walls we refer our readers to the answers to two other correspondents putting the same question in THE HEATING AND VENTILATING MAGAZINE for March, 1917.

For figuring the combination of roof and hung ceiling the method used by the correspondent is practically correct but his figures make no allowance for the additional insulation secured by means of the air space. A simpler method is to assume the temperature of the air in the air space and then calculate the losses from the lath and plaster alone based on the temperature difference between the 70° in the room and the assumed temperature of air space. This is usually taken as 35° or 40°.

If greater accuracy is necessary the theoretical temperature of the air in the air space can be calculated from the following:

For every square foot of ceiling it is known that there will be a loss of 0.62 B.T.U. per degree, which loss will radiate into the air above the ceiling. This will warm the air so that the heat will warm the roof and be lost therefrom. It is known that the roof loss is 0.36 B.T.U. per degree and since the roof loss must be constantly made up by the heat from the ceiling below, it follows that a state of equilibrium will be reached when the roof loss equals the ceiling loss.

To find the theoretical temperature of the air in the air space it follows that this temperature must be such that the *difference between the room temperature and the air*

space temperature, times the co-efficient for the ceiling, must equal the difference between the outside temperature and the air space temperature, times the co-efficient for the roof, or

$TD_1 \times CE_1 = TD_2 \times CE_2$

when TD_1 is the temperature difference between air space and room

TD_2 is the temperature difference between air space and outside

CE_1 the co-efficient for the ceiling

CE_2 the co-efficient for the roof.

Then $TD_1 \times 0.62 = TD_2 \times 0.36$.

The sum of the two temperature differences must equal 70 if the room is 70° and the outside zero.

Then $TD_1 + TD_2 = 70$

and $0.62\ TD_1 = 0.36 TD_2$

or

$TD_1 + TD_2 = 70$

$0.62\ TD_1 - 0.36\ TD_2 = 0$

which may be solved for TD_1 as follows:

$0.36\ TD_1 + 0.36\ TD_2 = 25.2$

$0.62\ TD_1 - 0.36\ TD_2 = 0.0$

$0.98\ TD_1 = 25.2$

$TD_1 = 25.6$ say 26°

Then if $TD_1 + TD_2 = 70$

$TD_2 = 70 - 26$

$TD_2 = 44°$

Then the air space will be 26° below the room and 44° above the outside temperature or 44° F.

Proof—

$70° - 44° = 26°\ TD_1$

$26 \times 0.62 = 16.1$, say 16 B. T. U. loss through ceiling $44° - 0 = 44°\ TD_2$

$44 \times 0.36 = 15.8$, say 16 B. T. U. loss through roof.

These being equal the conditions are in a state of equilibrium and the correspondent's result checks with the loss obtained above.

In reply to correspondent's last question, the entire area of a window or door opening should be figured—*not* the glass or sash only.

Current Heating and Ventilating Literature.

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HEATING DEMAND

Average and Maximum Heating Demand. M. W. Ehrlich. 1800 w. Power—March 5, 1918. Method of computing the coal consumption. 20c.

STEAM AND ELECTRIC

Public Steam and Electric Systems. J. A. M'Hollan. 2000 w. Elec Wld—March 9, 1918. Analysis of the building heating situation in large cities. 20c.

Recent Tests on Pressed Steel Radiators.

Tests were recently completed at the University of Michigan by Professor J. E. Emswiler and H. E. Keeler on four pressed steel radiators in heights ranging from 14 to 38 in. and on one cast-iron radiator 38 in. in height.

Although the value of K (B.T.U. per hour per square foot per degree difference) was remarkably low for the pressed steel radiators, the report states that "the low value of K has no special significance except in comparison with other radiators. These pressed radiators appear to be able to keep the room temperature up to the same point as the cast-iron and do it by pushing out less heat per square foot of surface. If this is a fact, as appears from our tests, then it really matters little what K is, except that it raises a question that is hard to answer, and until we can answer it, our results will be open to possible suspicion."

The cast-iron radiator tested is the standard Rococo radiator, made by the American Radiator Company. The pressed steel radiators are the product of The American Pressweld Radiator Corporation and are made of a special copper-bearing sheet steel, shaped and then welded to form the sections.

The radiators were all tested in the same room (No. 244 in the Engineering Building, at the University of Michigan) and only one radiator operated at a time. The room was carefully sealed so that there was no circulation of air other than that induced by the radiator being tested.

All the tests were made at night. The room temperature was recorded at twelve different points and at varying heights from the floor to the ceiling. An anemometer was suspended above the center of the radiator, at its middle, to give a clue to the relative movement of the air.

The heat input to the radiator was determined by the "electrical method." A small boiler well insulated, received heat from an electric current through a resistance heater. The boiler was connected directly to the radiator, this constituting a complete one-pipe heating plant within the room. The electric current passed through a watt-hour meter arranged to give a definite indication for each 1⅔ watts, or 6 B.T.U. The pressure of steam, and, therefore, the temperature in the radiator, was automatically maintained

at any point desired. The number of watts, or heat units dissipated by the boiler itself was easily determined by calibration, and was, of course, deducted from the gross energy input, to secure the net performance of the radiator.

It was necessary to set the radiator upon a platform 6-in. above the floor because of the boiler. In order that the radiator should not be higher than it normally should be with respect to the windows, strips of heavy paper were pinned across the sash of the windows immediately adjacent, thus cutting off 6-in. of glass, corresponding to the elevation of the radiator.

THE METHOD OF TESTING

As soon as pressure was built up within the radiator, it was thoroughly purged of air. Usually, while this was being done, the watt-hour meter was calibrated by comparison with portable instruments. Observations were then begun, and repeated at intervals of 15 minutes. As each set of observations was completed, the temperatures at the three levels in the room were averaged and the averages plotted on time as abscissae. The watts absorbed during the 15-minute interval were computed and plotted. In this manner, there was presented to the eye a picture of input to radiator and its effect in the room temperature. After some time, input and effect settled down to a constancy, and the test was usually continued for an hour after such equilibrium had begun to be attained.

Following the completion of a test, the valve between boiler and radiator was closed. The pressure in the boiler was automatically maintained, and a calibration of the boiler could be obtained at this time. The hot radiator could be immediately disconnected in the meantime, and a new one substituted. The change could be effected, and pressure established in the new radiator within 20 minutes of turning steam off the radiator previously tested. It took some time to purge the new radiator of air, but as soon as this was done, the new test could be begun and continued in the manner described above.

THE RESULTS

The results appear in Tables I, II and III. Table I represents the general conditions prevailing during the tests, the principal dimensions of the radiators, the averages of the most important observations, and performance of the radiators as represented by the heat dissipated by them. Table II presents the averages of many accessory observations which do not enter into the calculations, but nevertheless may have much significance. Table III is a summary of the

TABLE I—RADIATOR TESTS—GENERAL RESULTS

General						
1. No. of Test	7	8	9	10	12	13
2. Date—1918	3-16	3-17	3-17	3-17	3-30	3-30
3. Time	10:30 P 11:30P	1:00 A 2:00A	3:30A 4:30A	5:20A 6:35A	9:00P 10:00P	11:30P 12:30A
4. Duration—minutes	60	60	60	75	60	60
5. Weather	Fair	Fair	Fair	Fair	Fair	Fair
6. Wind	None	None	None	None	None	None
Radiator Data						
7. Name		Rococo				
8. Type	Pr. St'l.	C. I.	Pr. St'l.	Pr. St.	Pr. St.	Pr. St.
9. No. Sections	21	12	16	20	20	10
10. No. columns	3	2	1	4	4	3
11. Length—inches	42	29 1/2	32	40	40	18
12. Width—inches	8	7 1/2	4 3/4	12	12	8
13. Height—inches	18	38	38	14	14	38
14. Rated Surface—sq. ft.	47 1/2	48	48	45	45	50
Average of observations						
15. Barometric Pr.—inches	29.46	29.46	29.22	29.22	29.18	29.15
16. Pressure in radiator—inches above at m.	4.80	4.80	4.80	4.80	4.72	4.72
17. Pressure in radiator—inches abs.	34.26	34.26	34.02	34.02	33.90	33.87
18. Pressure in radiator—pds. per. sq. in.	16.82	16.82	16.70	16.70	16.64	16.63
19. Temp. of steam in rad.	218.9	218.9	218.5	218.5	218.3	218.3
20. Room Temp.	73.9	74.1	73.4	73.3	80.2	79.9
21. Room humidity—per cent	33	31	29	30	33	38
22. Outside temp.	38.0	39.0	39.0	38.5	46.6	46.7
Computed Quantities						
23. Temp. diff. (19-20)	145.0	144.8	145.1	145.2	138.1	138.4
24. Gross watts input per hr.	2788	336.3	3003	2807	2551	2623
25. Watts per hr. dissipated from electric boiler	240	240	240	239	219	219
26. Net watts per hr. dissipated from radiator	2548	3123	2763	2568	2332	2404
27. B. T. U. per hr. from radiator	8698	10665	9432	8770	7964	8210
28. B. T. U. per. hr. per sq. ft.	184.1	222.2	196.5	194.9	177.0	164.2
29. B. T. U. per hr. per sq. ft. per degree, difference equals K	1.270	1.534	1.354	1.342	1.282	1.186
30. K for tests 12 & 13 increased by 4.7 per cent to correct for high Rm. Temp.					1.342	1.242

TABLE II—RADIATOR TESTS—SPECIAL TEMPERATURES

	7	8	9	10	12	13
1. No. of test.						
2. Type of Radiator	Pr. St'l.	C. I.	Pr. St'l.	Pr. Stl.	Pr. Stl.	Pr. Stl.
3. No. Sections	21	12	16	20	20	10
4. Length	42	29 1/2	32	40	40	18
5. Height.	18	38	38	14	14	38
6. Rated Surface, sq. ft.	47 1/4	48	48	45	45	50
7. Temp. air at floor, deg. F.	71.4	71.3	70.7	70.4	77.7	77.8
8. Temp. air 5 ft. from floor	72.0	72.4	71.7	71.6	79.6	79.2
9. Temp. air at ceiling	76.7	78.2	76.2	75.2	81.3	82.7
10. Nominal Temp. of room	73.9	74.1	73.4	73.3	80.2	79.9
11. Temp. 4 3/4 in. above top radiator	86.5	113.9	91.5	82.3	115.0	123.2
12. Temp. 4 1/4 in. in front of radiator and 8 in. below level of top of radiator	89.0	90.8	89.8	84.4	90.6	95.2
13. Dry bulb temperature, deg. F.	73.9	73.5	73.9	73.0	81.0	81.3
14. Wet bulb temperature, deg. F.	57.4	56.1	55.2	54.9	62.5	64.00
15. Humidity per cent	33	31	29	30	33	38
16. Temp. on far side of north wall	65.5	63.0	61.7	61.0	68.5	66.9
17. Temp. on far side of east wall	66.0	64.3	63.7	63.2	70.2	71.0
18. Temp. on far side of south wall	82.6	83.0	83.0	83.0	80.6	82.2
19. Velocity—ft. per min. thru anemom.	—	49	0	43	53	5.3

TABLE III—SUMMARY OF PERFORMANCE OF RADIATORS

Cast Iron radiator	38 in.	2-col, 12 sec.	48 sq. ft.	K equals 1.534
Pressed steel radiator	38 in.	1-col, 16 sec.	48 sq. ft.	K equals 1.354
Pressed steel radiator	38 in.	3-col. 10 sec.	50 sq. ft.	K equals 1.242
Pressed steel radiator	18 in.	3-col, 21 sec.	47 1/4 sq. ft.	K equals 1.270
Pressed steel radiator	14 in.	4-col, 20 sec.	45 sq. ft.	K equals 1.342

performances of the several radiators arranged for convenient reference.

The report emphasizes the fact that "some very unusual results appear." In test No. 7, for instance "a pressed steel radiator 18 in. was on the stand. It dissipated heat at the rate of 8698 B.T.U. per hour and maintained the room at a temperature of 73.9° F., with the outside air at 38° F. The cast-iron radiator was then put on, and test No. 8 begun an hour and a half after test No. 7 was finished. It was found that this radiator required 10665 B.T.U. per hour to maintain the temperature of the room at 74.1° (0.2° higher than before) with the outside at 39°. Stated more concisely, it appears that the cast-iron radiator got away with nearly 23% more heat than the pressed steel radiator, without putting any more into the room. The question naturally arises as to where this 23% goes to, and I must confess that I am unable to answer it.

"As having a probable bearing on the question, it is to be noted that the temperature of the air above the pressed metal radiator is only 86.5° (test 7) vs. 113.9° above the cast-iron (test 8). But the pressed metal radiator of test 10 is only 18-in. high, while the cast-iron is 38-in. In test 13, where a pressed metal radiator of 38-in. height is used, the temperature above is 123.2°, although it must be remembered that the room temperature was much higher."

(In previous radiator tests, it has been brought out that it is difficult, if not impossible, to separate the radiant heat losses in a radiator from the convection heat losses. It is also not known how much radiant heat goes directly out through the walls and windows without being effective. Professor John R. Allen has stated that so far as he can determine, about half the heat in a radiator goes off by radiation and half by convection. Applying this ratio to the present experiments, the difference of 23% would mean that in radiant heat losses, pressed steel radiators give off 50% less by radiation than cast-iron. When a radiator is actually used it is ordinarily painted and if both types of radiators are painted with the same material, the radiant losses would depend upon the paint rather than on the material composing the radiator.)

Pressure and Temperature Control in an Office Building Supplied with Steam From a Central Station.

The control of the amount of steam entering a building for heating purposes has for many years received rather indifferent consideration. There may be two reasons assigned for this situation: First, where steam was sold on a meter basis, the control of steam consumption was not of vital interest to the company supplying this steam; second, where steam was sold on a flat-rate basis, the exact knowledge of the amount of steam delivered was lacking.

Investigations made by some of the members of the National District Heating Association, coupled with the demand for conservation of fuel, have led to a more definite inquiry into the control heat.

The results of a test made during the past winter at Peoria, Ill., in the office building of the Central Illinois Light Co., we believe are of sufficient interest to central stations to attract attention to the subject of control, especially at this time.

The valve employed on this test is the central station pressure and temperature control valve, developed by J. C. Hornung, of Chicago, and in this case, his magnetic pilot valve was used for controlling the temperature.

Fig. 1 shows the manner in which the clock and chart attachment was put on the

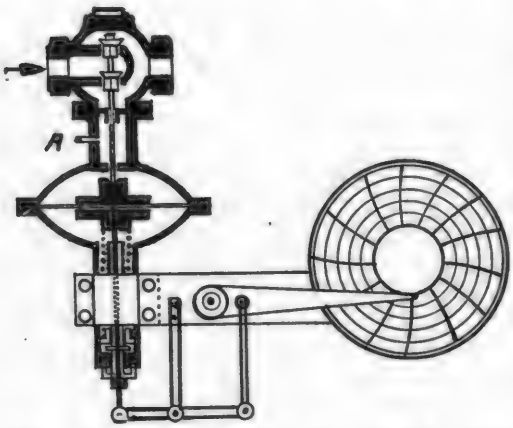


FIG. 1—ARRANGEMENT OF CLOCK AND CHART ATTACHMENT.

valve, so as to record the valve position throughout the 24-hour cycle.

It will be seen that in this valve, the pressure, as well as the temperature, is controlled. The adjustment for pressure is made with a coil spring enclosed in the diaphgram case and the adjustment screw is provided with keeper for seal or padlock. The valve under normal operation is thus shown to have two positions, one being a partly open position, to maintain the minimum pressure required, and the other a closed position when no heat is required.

A magnetic pilot valve was connected between the steam supply and the main valve case, at point marked A in Fig. 1.

When the pilot valve is closed, the valve acts purely as a pressure-control valve, but when the pilot is open, the supply pressure acts on the top of the diaphragm, thus closing the valve. It is also to be noted that there are no stuffing boxes, the clearances along steam forming passages for control.

The thermostat, which is the automatic switch for the pilot valve, is arranged so that lower temperatures may be carried during the night hours.

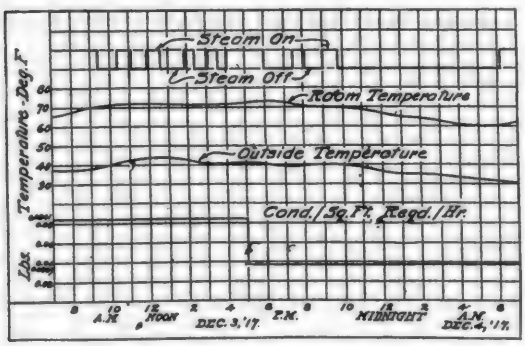
Two typical daily reports and graphs are shown to indicate the performance of the valve, and to present the interesting results in the form of daily steam consumption. The steam consumption per square feet of equivalent direct radiation per hour, which is now the standard unit, is especially interesting.

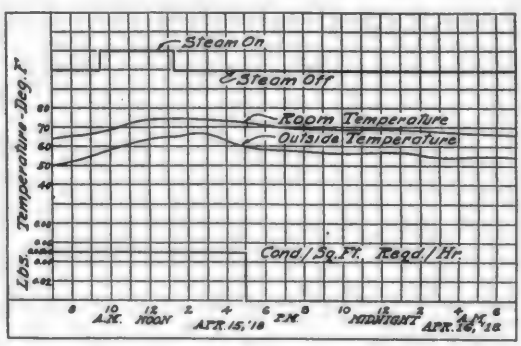
The test is instructive at this time when high fuel economies are so urgently requested.

H. R. Wetherell, engineer for Hodenpyl, Hardy & Co., and past president of the National District Heating Association, together with J. A. Strawn, superintendent of the steam department at Peoria, Ill., outlined the test. The daily observations and readings were made under the supervision of Mr. Strawn.

REPORT ON THERMOSTATIC DATA, DECEMBER 3-4, 1917.

1. Outside temperature. Max. 44°F., Min. 30°, Mean. 37°.
2. Thermostat lever set as follows—
3. Average inside temperature near thermostat, 65.1°.
4. Maximum inside temperature, 70.2°.
5. Minimum indoor temperature, 60.0°.
6. Service valve closed at—
7. Service valve opened at— } open entire period
8. Time in hours that service valve was opened, 24.
9. Time in hours that thermostat controlled steam supply, 24.
10. Number of times that thermostat shut off steam supply during above time, 8.
11. Hours that thermostat had steam shut off in this time, 15.
12. Total number of hours that steam was off building, 15; on building, 9.
13. Steam consumption (day), 4400 lbs. in 9.92 hours, 0.084 lbs. per square foot of equivalent direct required radiation per hour.





TYPICAL DAILY GRAPHS, OFFICE BUILDING TEST.

14. Steam consumption (night) 2700 lbs. in 14.00 hours 0.037 lbs. per square foot E. D. R. per hour.
15. Steam consumption (total in 23.92 hrs.) 7100 lbs. or 0.057 lbs. per square foot E. D. R. per hour.

REPORT ON THERMOSTATIC DATA, APRIL 15-16, 1918.

1. Outside temperature. Max. 76°F., Min. 50°. Mean. 63°.
2. Thermostat lever set as follows—
3. Average inside temperature. near thermostat, 71°.
4. Maximum inside temperature, 74°.
5. Minimum indoor temperature, 68°.
6. Service valve closed at—
7. Service valve opened at— } open entire period
8. Time in hours that service valve was opened, 24.
9. Time in hours that thermostat controlled steam supply, 24.
10. Number of times that thermostat shut off steam supply during above time, 1.
11. Hours that thermostat had steam shut off in this time, 22¼.
12. Total number of hours that steam was off building, 22¼; on building, 1¾.
13. Steam consumption (day), 1200 lbs. in 9.83 hours, 0.023 lbs. per square foot of equivalent direct required radiation per hour,
14. Steam consumption (night), 100 lbs. in 14.42 hours, 0.001 lbs. per square foot E. D. R. per hour,
15. Steam consumption (total in 24.25 hrs.) 1300 lbs. or 0.012 lbs. per square foot E. D. R. per hour.

What Instruments Are Useful and Desirable in the Boiler Room as Aids in Saving Coal?

Efforts to get away from the old idea of having meters and recorders in the boiler room to "show up" the fireman, were urged by E. G. Bailey in his contribution to the coal symposium at the meeting of the American Society of Mechanical Engineers, in Worcester, June 6. Mr. Bailey advocated the use of meters that will actually assist the fireman to carry the load required of his boilers and, at the same time, obtain the maximum efficiency that is possible at that load. He used the word "meter," he said, in its broad sense to include all instruments down to a coal scale when they are used to obtain knowledge regarding boiler-plant conditions.

Mr. Bailey described the principal controllable losses in boiler operation as (1) combustible in ashes and refuse; (2) excess air; (3) unburned gas; and (4) high temperature of flue gases. He then divided meters into four types: (1) condition; (2) total; (3) rate; and (4) relation. From an operating standpoint he said the meters which show rate, including boiler feed, steam flow, air flow, stoker speed, etc., are the most important, as it is better for a fireman to know the rate of steam output from each boiler continuously than to wait until the end of his shift and learn the average rate from a water meter that integrates total only. Of course, time is an important factor in boiler operation and the fireman should know final results promptly and continuously.

Another important relation is that between rate of steam generation and rate at which fuel is burned. With coal, about the closest approach is the relation between the steam flow meter and tachometer on the stoker drive, although he added that this was a very crude method of determining the rate at which the B.T.U. are supplied to the furnace.

There is another relation, however, that is analagous to the steam-flow ratio that is readily obtained and of even greater value. It is the relation between the rate of steam flow from the boiler and the rate of air flow which supports combustion. Mr. Bailey stated that the amount of air required to develop a given number of B. T. U. is practically independent of the character or quality of coal being used.

Mr. Bailey recommended the use of recording, rather than indicating, meters, and stated that power plant engineers were rapidly adopting this type, especially where indicating meters had previously been used.

Newport Boiler Company Wins Suit Brought Against It by the Spencer Heater Company.

The United States Circuit Court of Appeals, Judges Baker, Mack and Evans sitting, on May 3, 1918, rendered a unanimous decison in Case Number 2551—Spencer Heater Company vs. Newport Boiler Company, affirming a decree of the District Court for the Northern District of Illinois.

This suit was brought more than two years ago by the Spencer Heater Company against the Newport Boiler Company and it was alleged that the magazine-feed boilers sold by the Newport Boiler Company were infringements of certain patents owned by the Spencer Heater Company. The District Court held that patent No. 1,045,668, owned by the Spencer Heater Company, for a so-called double-type sectional, magazine-feed boiler and patent No. 1,063,088, also owned by the same company, for a so-called single-type sectional, magazine-feed boiler, were not infringed by the sectional boilers sold by the Newport Boiler Company. The Spencer Heater Company appealed from this decision with the result above noted.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Plans for Buffalo Meeting.

Sessions on drying, district heating and coal conservation are included in the programme for the mid-summer meeting of The American Society of Heating and Ventilating Engineers which will be held in Buffalo, N. Y., June 26-28.

C. A. Booth, sales manager of the Buffalo Forge Company, is chairman of the local entertainment committee and according to the arrangements made, the afternoon sessions on Thursday, June 27, will be held at the Buffalo Canoe Club on the Niagara River followed by a dinner and dance at the clubhouse.

Society's New Year Book.

A total of 769 members is listed in the new year book of the society which has just been published for 1918. In addition there are 35 applications for membership in the hands of Secretary C. W. Obert. All the officers are listed, both of the society and of the various chapters, together with the personnel of the society's different committees. A complete list is added of the past officers of the society.

New York Chapter's Annual Dinner.

War work and practical considerations for the heating engineer shared the honors at the annual dinner of the New York Chapter which was held at the Building Trades Club, New York, May 20. The war speakers included W. O. Wilson, who told of Y. M. C. A. work in France, and Wayne M. Musgrave, whose subject was the Red Cross.

The main address of the evening was given by Milton W. Franklin on "Spontaneous Combustion." Mr. Franklin's talk showed a thorough study and understanding of the subject and he held the close attention of his audience throughout his address. Walter S. Timmis expressed his appreciation of Mr. Franklin's paper and paid a tribute to the work of the chapter during the past year, closing by calling for a rising vote of thanks to President Chew. Other speakers were Past President J. I. Lyle and G. W. Martin, president of the National District Heating Association.

Annual Dinner and Dance of Illinois Chapter.

President Frederick R. Still of the heating engineers' society was the guest of honor at the annual dinner and dance of the Illinois Chapter, which was held May 13 at the Chicago Athletic Club. Following the dinner, which was accompanied by entertainment features, President E. Vernon Hill of the Illinois Chapter, addressed the members and then presented President Still as the speaker of the evening. Mr. Still made an interesting address on the Irish question, based on his personal observations during his trip to Ireland two years ago. He expressed his belief that conscription would be a blessing in disguise for Ireland.

At the close of his address he was given a rising vote of thanks.

Kansas City Chapter Appoints Legislative Committee.

Following the discussion of "Heating and Ventilation of School Buildings," which was the principal topic at the chapter's April meeting, the chapter appointed a committee on legislation, consisting of Stanley Field, chairman; and J. H. Kitchen, W. E. Gillham, F. J. McMorran and N. W. Downes, to cooperate with a similar committee of the Kansas City Chapter of the American Institute of Architects.

At the annual meeting of the Kansas State Association of Public Health officers, held in Topeka May 23-24, the speakers included John H. Kitchen, secretary of the Kansas City Chapter, who presented a paper on "Heating and Ventilating School Buildings."

New Edition of Gifford's "Central Station Heating."

An idea of the rapid progress that has been made in the development of central station as well as changed conditions under which the industry is operating is presented in the new edition of "Central Station Heating," by Byron T. Gifford. In addition to a careful revision of the text in the first edition, Mr. Gifford has added important new chapters covering the subjects of "Accounting," with details of a cost and accounting system in straight and combination plants; "Economics and Design of High-Pressure Distribution Systems," "Modern Insulation and Construction," and "Replacement and Renewal Reserve and How To Figure It."

Of the new matter appearing in the second edition, that on "Accounting" will undoubtedly take rank as the most complete discussion of the subject that has appeared in print. Under this heading the author deals with the classification of accounts for heating utilities and the division of costs and expenses between the heating and electric departments in a combination property. The classification is not new but, on the contrary, is one that has been found to work out successfully in use. The added information brought out in this chapter alone is probably sufficient to justify the publication of the new edition.

An important feature of central station operation these days is the necessity of keeping the property intact by creating an annual reserve for replacement and renewal purposes. This subject is now given the attention it deserves.

The addition of a chapter on "The Design of High-Pressure Steam Distribution System," supplements very nicely the matter in the first edition on the design of low-pressure systems. In connection with this matter the author presents a new high pressure pipe chart that will greatly facilitate the solution of these problems.

"Central Station Heating," is recognized as a standard manual on the subject of district heating and has served, in many cases, as a guide in the deliberations of public utility commissions in the establishment of fair rates for the sale of steam and hot water. The author's well-known reputation for conservatism and sound engineering, which was reflected in his treatment of what was at the time the first complete manual on the subject of district heating, will be enhanced by his further treatment of the subject.

The second edition of "Central Station Heating" is now on the press. It will be issued about June 15. The new edition will be bound in cloth and will sell for $3.00 postpaid. The publishers are the Heating and Ventilating Magazine Company.

Proposed Rules and Contract Form for Central Station Hot Water Heating in Indiana.

The central station hot water heating utilities have, in the past, been billing their consumers upon square feet of radiation required by formula and not upon square feet of radiation set, and on account of the abuse of the application of this principle, the hot water heating problem has been forced to an acute situation by what is described by the State Public Service Commission as high and unreasonable billing and a lack of good service. The Commission is desirous of basing the billing for hot water heating service on something tangible which both the utility and the consumer may see, measure and agree to, and after the correct number of square feet of radiation has been established, to standardize the number of B.T.U. per square foot of radiation which the utility is supposed to provide for corresponding outside temperatures.

As a result of this situation a set of proposed rules and a proposed contract form have been prepared by the Public Service Commission of Indiana in collaboration with the United States Bureau of Standards. At a conference held in Indianapolis on June 4, all of the central station hot water heating interests in the State were asked to be present, as well as sevservice. It was hoped that at that conference the tentative rules and contract form could be thoroughly discussed and the way paved for their adoption in their present or in an amended form.

As soon as the rules and contract form are promulgated in their final form a digest of their salient features will be presented in these columns.

A Plug-Type Radiator Valve.

It is a good mechanical principle that the best device is the one that fulfils its purpose in the most direct manner, with the least motion and the least number of working (which means wearing) parts. The plug type of valve which has been placed on the market by the Gorton & Lidgerwood Co., New York, is described by the manufacturers as fulfilling these requirements in being simple, direct in operation, and opening and

GORTON PLUG-TYPE RADIATOR VALVE.

CONSTRUCTION OF GORTON PLUG-TYPE RADIATOR VALVE.

closing with the minimum of motion. The accompanying illustrations show a type of plug valve which has been developed for radiator work. The principal feature is the plug, or disc, which is made of a composition, and not of metal. This composition is a mineral substance and, it is stated, contains neither sulphur nor rubber, so that it is not affected by steam or by hot or cold water. In the manufacture of the composition the substance is cast in a master steel mould and compressed under heavy hydrostatic pressure. It is then machine ground to a taper surface and carefully gauged as to accuracy in a master steel cup gauge.

The valve seat is the entire inner surface of the valve, this arrangement providing a large bearing surface for the disc. The interior is bored, reamed, finished to the same taper as the disc and tested for accuracy with a master steel plug gauge. Emphasis is laid on the point that the seat and disc, being ground to the same taper surfaces, permit as close contact as it is possible to produce. The disc has the same ratio of heat expansion as the valve body and, being a mineral composition disc working in a metal seat, both ground to the same taper, will, it is claimed, not cut or wedge. It is also pointed out that the composition in the plug will not rust or corrode.

A quarter turn of the lever handle turns the plug from full open to closed position. Another advantage, it is stated, is in the packing features. There is no horizontal motion of the valve stem, a radial turning of the stem actuating the plug. Therefore it is possible to use a packing lock stem. There is a ground shoulder on the valve stem which seats itself on the ground seat on the under side of the stem opening in the valve bonnet. This is the same principle that is used successfully in safety valve construction. The valve stem also has a groove which is fitted with soft, but firm, packing rings, these rings being forced and locked into the groove by means of a gland forced down by the packing box nut, making a packing lock. These two features, it is added, are only possible in the plug-type of valve. Finally, the steam or water has a clear, unobstructed passageway through the valve.

Deaths.

GEORGE O'HANLON, of New York, well known in the local heating trade and a member of the heating engineers' society, was fatally injured in an automobile accident May 19. He died shortly afterwards at the New York Hospital. Mr. O'Hanlon was born in Ireland in 1867. He was identified with the early activities in the heating industry in this country, being associated with Edward E. Gold & Company and with Blake & Williams. Later he entered business for himself as a consulting heating and ventilating engineer. He is survived by a widow and one child.

FREDERICK REMSEN HUTTON, honorary secretary of The American Society of Mechanical Engineers and a former president of that society, died at his home in New York, May 14. He was 64 years old. Professor Hutton was emeritus professor of mechanical engineering at Columbia University.

CHARLES JENKINS, for many years connected with Jenkins Bros., New York, died May 1 at his home in Winthrop, Mass. He was 73 years old. Mr. Jenkins retired from the firm in 1896 and has since devoted his time to his real estate interests. His brother, Alfred B. Jenkins, president of Jenkins Bros., died a little over a year ago.

F. E. LALLY, manager of the New York branch of Crane Company, died in New York, April 3.

Central Station Steam Co., Detroit, Mich., announces that D. T. Wallace, formerly manager of the sales department of the New York Steam Co., has become associated with the Central Station Steam Company as manager of its Minneapolis branch.

RULES FOR FLANGED FITTINGS.

American 1915 Standard, Standard Weight.

1. Standard reducing elbows carry same dimensions center-to-face as regular elbows of largest straight size.

2. Standard tees, crosses and laterals, reducing on run only, carry same dimensions face-to-face as largest straight size.

3. Where long-turn fittings are specified, it has reference only to elbows which are made in two center-to-face dimensions and to be known as "elbows" and "long-turn elbows," the latter being used only when so specified.

4. All standard weight fittings must be guaranteed for 125 lbs. working pressure, and each fitting must have some mark cast on it indicating the maker and guaranteed working steam pressure.

5. Standard weight fittings and flanges to be plain faced, and bolt holes to be ⅛ in. larger in diameter than bolts; bolt holes to straddle center lines.

6. Size of all fittings scheduled indicates inside diameter of ports.

7. Square head bolts with hexagonal nuts are generally recommended for use.

8. Double-branch elbows, side-outlet elbows and side-outlet tees, whether straight or reducing sizes, carry same dimensions center-to-face and face-to-face as regular tees and elbows.

9. Bull-head tees or tees increasing on outlet, will have same center-to-face and face-to-face dimensions as a straight fitting of the size of the outlet.

10. Tees, crosses and laterals 16-in. and smaller, reducing on the outlet, use the same dimensions as straight sizes of the larger port.

Sizes 18-in. and larger, reducing on the outlet, are made in two lengths, depending on the size of the outlet, as given in the table of dimensions.

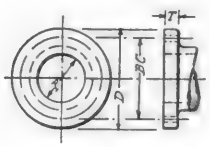
11. For fittings reducing on the run only, a long-body pattern will be used. Y's are special and made to suit connections. Double-branch elbows are not made reducing on the run.

12. Steel flanges, fittings and valves are recommended for superheated steam.

13. If flanged fittings for lower working pressure than 125 lbs. are made, they shall conform in all dimensions, except thickness of shell, to this standard and shall have the guaranteed working pressure cast on each fitting. Flanges for these fittings must be standard dimensions.

1915 Standard Weight Flanges and Bolts.

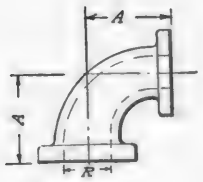
125 Lbs. Working Pressure



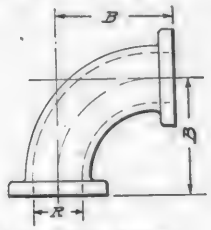
PIPE Size in. diam. P	FLANGE Diam. in. D	Thickness in. T	BOLTS No.	Size In. diam.	Bolt circle In. B. C.	Bolt Holes Size In. diam.
1	4	7/16	4	7/16	3	9/16
1 1/4	4 1/2	1/2	4	7/16	3 3/8	9/16
1 1/2	5	9/16	4	1/2	3 7/8	5/8
2	6	5/8	4	5/8	4 3/4	3/4
2 1/2	7	11/16	4	5/8	5 1/2	3/4
3	7 1/2	3/4	4	5/8	6	3/4
3 1/2	8 1/2	13/16	4	5/8	7	3/4
4	9	15/16	8	5/8	7 1/2	3/4
4 1/2	9 1/4	15/16	8	3/4	7 3/4	7/8
5	10	15/16	8	3/4	8 1/2	7/8
6	11	1	8	3/4	9 1/2	7/8
7	12 1/2	1 1/16	8	3/4	10 3/4	7/8
8	13 1/2	1 1/8	8	3/4	11 3/4	7/8
9	15	1 1/8	12	3/4	13 1/4	7/8
10	16	1 3/16	12	7/8	14 1/4	1
12	19	1 1/4	12	7/8	17	1
14	21	1 3/8	12	1	18 3/4	1 1/8
15	22 1/4	1 3/8	16	1	20	1 1/8
16	23 1/2	1 7/16	16	1	21 1/4	1 1/8
18	25	1 9/16	16	1 1/8	22 3/4	1 1/4
20	27 1/2	1 11/16	20	1 1/8	25	1 1/4
22	29 1/2	1 13/16	20	1 1/4	27 1/4	1 3/8
24	32	1 7/8	20	1 1/4	29 1/2	1 3/8
26	34 1/4	2	24	1 1/4	31 3/4	1 3/8
28	36 1/2	2 1/16	28	1 1/4	34	1 3/8
30	38 3/4	2 1/8	28	1 3/8	36	1 1/2
32	41 3/4	2 1/4	28	1 1/2	38 1/2	1 5/8
34	43 3/4	2 5/16	32	1 1/2	40 1/2	1 5/8
36	46	2 3/8	32	1 1/2	42 3/4	1 5/8
38	48 3/4	2 3/8	32	1 5/8	45 1/4	1 3/4
40	50 3/4	2 1/2	36	1 5/8	47 1/4	1 3/4

1915 Standard Weight Elbows and Reducers.

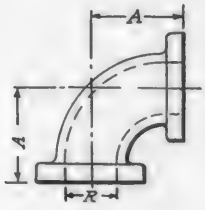
125 Lbs. Working Pressure



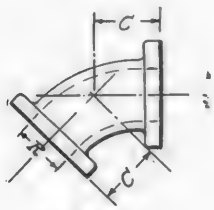
Elbow.



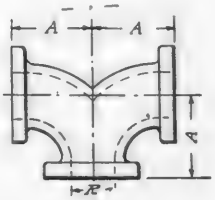
Long-Turn Elbow.



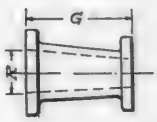
Reducing Elbow.



45° Elbow.



Double-Branch Elbow.

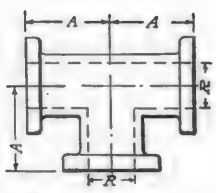


Reducer.

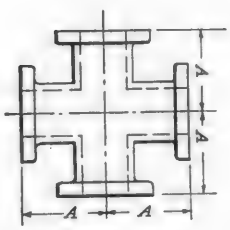
SIZE In. Diam. R	DIMENSIONS, In. A	B	C	G	FLANGE Diam. In.	Thickness In.
1	3 1/2	5	1 3/4	—	4	7/16
1 1/4	3 3/4	5 1/2	2	—	4 1/2	1/2
1 1/2	4	6	2 1/4	—	5	9/16
2	4 1/2	6 1/2	2 1/2	—	6	5/8
2 1/2	5	7	3	—	7	11/16
3	5 1/2	7 3/4	3	6	7 1/2	3/4
3 1/2	6	8 1/2	3 1/2	6 1/2	8 1/2	13/16
4	6 1/2	9	4	7	9	15/16
4 1/2	7	9 1/2	4	7 1/2	9 1/4	15/16
5	7 1/2	10 1/4	4 1/2	8	10	15/16
6	8	11 1/2	5	9	11	1
7	8 1/2	12 3/4	5 1/2	10	12 1/2	1 1/16
8	9	14	5 1/2	11	13 1/2	1 1/8
9	10	15 1/4	6	11 1/2	15	1 1/8
10	11	16 1/2	6 1/2	12	16	1 3/16
12	12	19	7 1/2	14	19	1 1/4
14	14	21 1/2	7 1/2	16	21	1 3/8
15	14 1/2	22 3/4	8	17	22 1/4	1 3/8
16	15	24	8	18	23 1/2	1 7/16
18	16 1/2	26 1/2	8 1/2	19	25	1 9/16
20	18	29	9 1/2	20	27 1/2	1 11/16
22	20	31 1/2	10	22	29 1/2	1 13/16
24	22	34	11	24	32	1 7/8
26	23	36 1/2	13	26	34 1/4	2
28	24	39	14	28	36 1/2	2 1/16
30	25	41 1/2	15	30	38 3/4	2 1/8
32	26	44	16	32	41 3/4	2 1/4
34	27	46 1/2	17	34	43 3/4	2 5/16
36	28	49	18	36	46	2 3/8
38	29	51 1/2	19	38	48 3/4	2 3/8
40	30	54	20	40	50 3/4	2 1/2

1915 Standard Weight Crosses and Laterals.

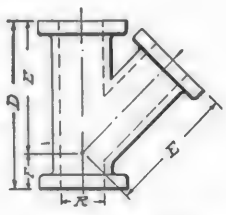
125 Lbs. Working Pressure



STRAIGHT TEE.



STRAIGHT CROSS.



STRAIGHT LATERAL.

SIZE In. Diam. R	DIMENSIONS In. A	D	E	FLANGES Diam. In.	Thickness In.
1	3 1/2	7 1/2	5 3/4	4	7 16
1 1/4	3 3/4	8	6 1/4	4 1/2	1/2
1 1/2	4	9	7	5	9/16
2	4 1/2	10 1/2	8	6	5/8
2 1/2	5	12	9 1/2	7	11/16
3	5 1/2	13	10	7 1/2	3/4
3 1/2	6	14 1/2	11 1/2	8	13/16
4	6 1/2	15	12	9	15/16
4 1/2	7	15 1/2	12 1/2	9 1/4	15/16
5	7 1/2	17	13 1/2	10	15/16
6	8	18	14 1/2	11	1
7	8 1/2	20 1/2	16 1/2	12 1/2	11/16
8	9	22	17 1/2	13 1/2	1 1/8
9	10	24	19 1/2	15	1 1/8
10	11	25 1/2	20 1/2	16	1 3/16
12	12	30	24 1/2	19	1 1/4
14	14	33	27	21	1 3/8
15	14 1/2	34 1/2	28 1/2	22 1/4	1 3/8
16	15	36 1/2	30	23 1/2	1 7/16
18	16 1/2	39	32	25	1 9/16
20	18	43	35	27 1/2	1 11/16
22	20	46	37 1/2	29 1/2	1 13/16
24	22	49 1/2	40 1/2	32	1 7/8
26	23	53	44	34 1/4	2
28	24	56	46	36 1/2	2 1/16
30	25	59	49	38 3/4	2 1/8
32	26	—	—	41 3/4	2 1/4
34	27	—	—	43 3/4	2 5/16
36	28	—	—	46	2 3/8
38	29	—	—	48 3/4	2 3/8
40	30	—	—	50 3/4	2 1/2

FITTINGS—Std. Wt. Straight Tee Crosses and Laterals, Flanged. | No. 107-C.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

Central Supply Association will hold its summer meeting in Chicago, June 20. Headquarters will be at the Congress Hotel. The meeting of the Trade Extension Committee, which is conducting the publicity campaign for new equipment for old buildings has been set for Friday, June 21, in Chicago.

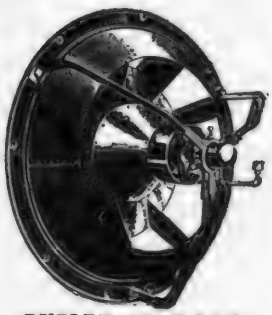
Sale of Food and Fuel by Municipalities in New Jersey is provided for in a recent law authorizing such action for the period of the war and six months thereafter. The purpose of the law is to permit municipalities to help in the relief of the food and fuel situations and to this end they are permitted to acquire storehouses in which to store and from which to sell foods and fuel. It is provided that those in charge shall daily publish in the newspapers a list of articles purchased by them on the preceding day, with the quantity of each article, the name and address of the seller and the price at which such article was purchased.

Otto E. Goldschmidt, consulting engineer, New York, announces the removal of his offices to 116 West 39th Street.

Engineering Societies Library, 29 West 39th St., New York, calls attention anew to its service in the way of furnishing complete copies of magazine articles, translations of foreign articles, and lists of references to books and articles on any technical subject.

Future Location of Power Stations are discussed by D. C. Ashmead in a recent issue of *Power* in which he states:

"The fuel problem does not lie in the inability of the mines to produce the coal, but rather in the inability of the railroads to transport it." He suggests that the country be divided into districts, each served with



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with **Motors, Duct Work** and **Wiring.**

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

electric power generated by central stations located at the sources of fuel supply. Tables show production of coal and coke in 1916 and generation of electric current by steam in 1917, by States.

Building Operations for April, 1918, are about 40% below those for the corresponding period in 1917, without taking into account the Government's big building schedule. Official reports received from 115 principal cities by the *American Contractor,* Chicago, show that the total of building permits came to $51,296,161, as compared with $85,902,006 for April, 1917. The larger cities all showed losses, New York's decline being 26%. The loss in Philadelphia was 52%, Boston 70%, Chicago 70% and St. Louis 68%. The Pacific Coast cities made relatively good showings. St. Paul, Minn., was a notable exception to the general rule. The building operations in that city jumped from $877,244 in April, 1917, to $6,776,218 this April. Tacoma, Wash., gained 132% and Washington 110%.

National Association of Sheet Metal Contractors, whose annual convention is being held this year in Milwaukee, June 11-14, devoted its session on the afternoon of June 11 to warm-air furnace heating.

HIGH EFFICIENCY TRADE
SELF-COOLED MOTOR ILG PROPELLER FANS
VENTILATING MARK MACHINERY

Self-Cooled Motor Propeller Fans

Showing Self-Cooled Propeller Fan Used for Drying Leather Belting

Can be Used for Cooling - Ventilating - Drying - Exhausting

One Name Plate on Fan and Motor - ILG

We have in stock more than 2000 Motors for Propeller Fans - We can ship quickly

"IF IT'S SELF-COOLED IT'S AN ILG"

ILG ELECTRIC VENTILATING CO.

158 Whiting Street, Chicago

Branches—All Large Cities

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

DETROIT PACKLESS RADIATOR VALVES

The Correct Valve for the Beautiful Home

Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY LTD. WALKERVILLE, ONTARIO

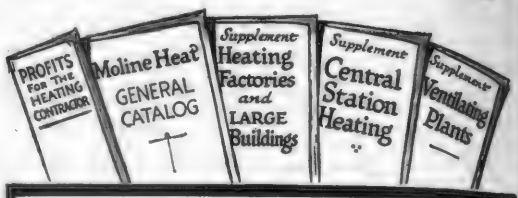
LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

The scheduled speakers included Professor John R. Allen, University of Minnesota, who was down for a thirty-minutes' review of "Hot Air Furnaces and Their Use"; D. Rait Richardson, president, and A. W. Williams, secretary, of the National Warm Air Heating and Ventilating Association; and S. E. Riley, sales manager for the L. J. Mueller Furnace Co., whose subject was "Pipeless Furnace Heating."

National Association of Purchasing Agents held a conference in Chicago, May 22, at the Hotel La Salle to take steps to determine standard sizes for catalogues and to discuss the standardization of all advertising literature.

Overhaul Your Heating Plant Before Next Fall is a timely warning carrying more than the usual significance, which is being sent out by W. W. Smith, member of the Fuel Administration for Chicago. While the recommendations are well known, it will pay to repeat them as offering suggestions for the furtherance of the "new equipment for old buildings" movement. In his warning Mr. Smith states:

"Whether one uses steam heat, hot water system, hot air distribution, or stoves, economy will shun cheapness and insist on qual-



THESE VALUABLE BOOKS *FREE!*

Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

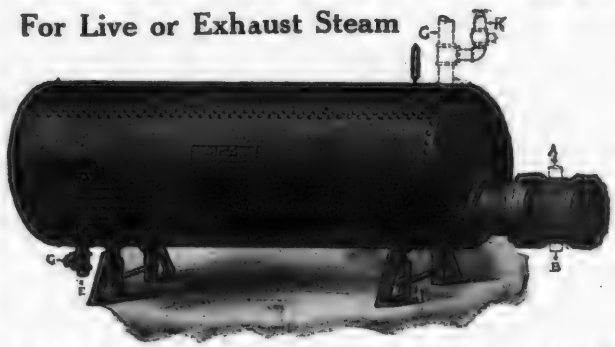
These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely ***FREE!***

Moline Illinois

Sims Clean E-Z Steam Tube Heater

For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings Schools, etc.

For Live or Exhaust Steam



requiring large quantities of hot water. This type of heater should be used in preference to circulating generator and storage tank—or instantaneous heaters.

Special attention given to all kinds of water heating problems based on long experience in this work.

Valuable tables have been prepared, showing heater capacities using steam at various pressures. These tables are yours for the asking.

THE SIMS CO., 18th St., Erie, Pa.

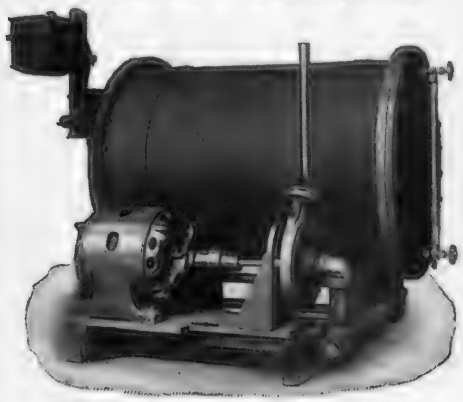
ity. Even when the best in design and installation is secured, regular annual overhauling is expedient. The extremes of heat and cold to which its parts are subjected, straining all joints, the action of dampness and acids formed from coal products, the accumulation of soot, and the dirt carried in air currents, besides all accidental burning out or breakage of parts, make thorough examination, with repairs and renewals where necessary, a most important feature of home management."

Camp Grant, Ill.—Lime in the water supply at Camp Grant has caused so much trouble with the boiler of the steam heating plant that a treating plant will be built for the water service. When the proposed additional building programme for the camp has been approved in Washington it is announced that the water and steam heating plants will be enlarged at least 25%. Major H. B. De Long, an engineer from the construction division of the War Department, has been at Camp Grant, making a survey of the water and steam heating situation.

Chicago, Ill.—Immediate reconstruction of domestic heating plants is being urged by the Smoke Inspection Department of Chicago so that such plants will be able to burn

WAR-TIME ECONOMY

demands the use of fuel-saving devices



ARCHITECTS AND ENGINEERS

designing new plants generally provide for economical equipment, but there are many existing low pressure steam heating plants where a surprising amount of fuel could be saved by the installation of

Yeomans Electrically Operated Condensation Return Pumps

Made in Horizontal and Vertical Types for automatic operation

Send for Bulletin C-5000. Agents in all principal cities.

YEOMANS BROTHERS CO.
223 Institute Pl. Chicago, Ills.

There are two Profits in this Radiator Trap for You—
THE next time you make up an estimate on a two-pipe heating system you can figure on two profits by using Johns-Manville Radiator Traps —one profit on the sale and one on the installation.
There is no danger of your having to sacrifice your sale profit for we protect you there.
And the radiator trap itself protects your installation profit for its simplicity makes it the fastest trap to install. And once installed there are never any callbacks for it is self adjusting and tinker proof. Ask any branch for booklet and prices.
H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 61 Large Cities
JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT
Johns-Manville Radiator Trap

Illinois coal without smoke. This action is being taken on account of the coal administration's ruling that Illinois is to get no smokeless coal until further notice. Frank A. Chambers, engineer for the department, urges prompt attention to this matter since the plants are shut down now. The notice sent to every violator of the smoke ordinance is a special one and reads, in part:

"The fuel administration of the United States government has withdrawn smokeless or Pocahontas coal from the Chicago market, and you will be compelled to burn bituminous coal in the future. You should, therefore, take advantage of the mild weather to equip your boiler so that it can be operated without the emission of dense smoke.

"Please give this matter your immediate attention, as suit will be instituted against you on all violations reported after ten days from date, unless steps have been taken by you to remedy conditions."

The campaign does not involve the pushing of any patented device or method. This is made plain in the fuel administration's circular.

"Of the constructions which seem to give promise of meeting conditions the so-called 'fire arch setting,'" reads this circular, "is the most widely used. A number of firms have succeessfully applied this principle, which consists mainly of an arch installed in the fire-box."

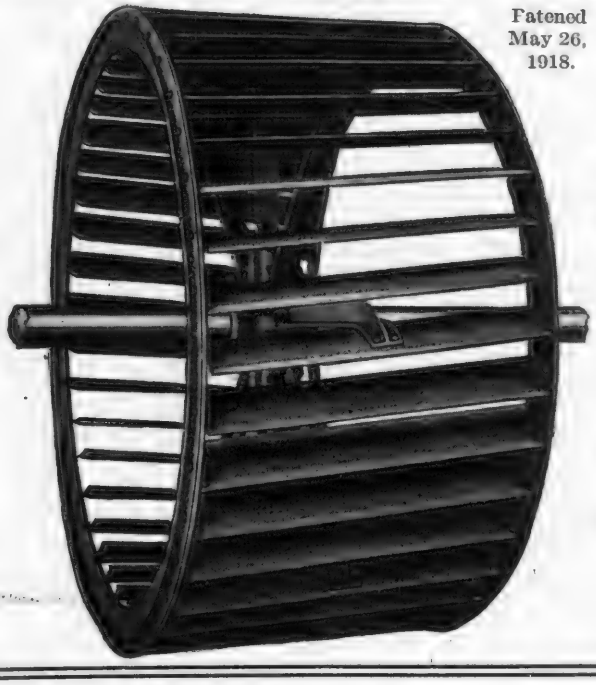
American Institute of Architects started a movement at its recent annual meeting towards "federating the whole building industry of the United States, in order that the Government may have the most intelligent support and powerful co-operation of all the interests involved." As a first step in this direction a committee of the Institute called a meeting at the Engineering Societies Building June 14, to discuss the situation. All representatives of the building industry were invited to be present, including national and important local associations. The conference was a direct result of discussion at the Institute's recent annual meeting when the speakers emphasized the importance of keeping the building industries going. D. Knickerbacker Boyd, editor of the Institute's "Structural Service" publications, at that time, offered the following concrete suggestions:

First: Bring into active co-relation with the work of the Institute every allied effort which is being made to standardize building methods and materials.

Second: Give to architects to make use of

THIS IS WHAT WE HAVE BEEN "BLOWING" ABOUT!

THE NEW IMPROVED **Cycloidal Multivane Wheel**



Patened May 26, 1918.

For Heating and Ventilating

The vanes are curved forward, and set at an angle to the shaft, (patented feature) allowing uniform, unrestricted flow of air across entire width of wheel.

Highest Efficiency

Noiseless and Durable

Write for further details

Garden City Fan Co.

Est. 1879

CHICAGO, ILL.

Eastern Representatives:
L. J. WING MFG. CO., New York

In World's Finest Newspaper Plant

Two complete units of Sirocco Air Purifying Systems are serving in the new home of the Detroit News—undoubtedly the most modern newspaper plant in existence.

The top illustration at the left shows one of the two Sirocco Fan Outfits. The lower illustration shows one of the two Sirocco Air Purifying Systems.

It was our privilege to co-operate with Architect Albert Kahn, of Detroit, and the General Contractors, George A. Fuller Co., of Detroit, in the application of this Sirocco Equipment.

Our Engineering Department is glad to co-operate with Architects, Engineers and Contractors in connection with Sirocco application.

American Blower Co.

Detroit, Michigan

Branches in all Large Cities

Canadian Sirocco Co., Ltd.
Windsor, Ont.
Manufacturers for Canada

all standardizations whenever they have been reached and passed upon by competent organized bodies.

Third: Encourage architects to make use of all standardizations whenever they have been reached and passed upon by competent organized bodies.

Fourth: To encourage manufacturers to continue through properly constituted bodies, their efforts toward solving problems of standardization, to the end that the resultant savings may reduce the cost of building.

Fifth: Through the quick and orderly dissemination of all such information, bring the architect, the producer and the manufacturer into the closest possible contact, without loss of time and with the minimum of expense to each.

Manufacturers' Notes.

Alberger Pump & Condenser Co., New York, announces the election of the following officers at a recent meeting of the company's board of directors: Chairman of the board, George Q. Palmer; President, William S. Doran; secretary, Richard C. Williams; treasurer, Frederick A. Brockmeier.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has completed the construction of its South Philadelphia works, now devoted entirely to the production of ship-propulsion machinery for the navy and merchant fleet. A record was made in the construction of this plant. A little over a year ago the present site was plowed field. Now it contains seven large buildings which give employement to 2500 people. These buildings comprise a floor space of over 600,000 sq. ft. It is expected that eventually this plant, which is located about nine miles from Philadephia, on the Delaware River, will be of a size comparable with the company's East Pittsburgh works, which employs 25,000 people.

N. O. Nelson, president of the N. O. Nelson Mfg. Co., St. Louis, Mo., announces his resignation after 46 years as active head of the firm. He is succeeded by L. D. Lawnin as president. Mr. Nelson will remain as director and general advisor.

American Radiator Co., Chicago, Ill., has placed a contract for a new one-story foundry building 80x100 ft., at its plant in Titusville, Pa., to cost $25,000.

"AUTOVENT"
Motor Driven Propeller Fans

The very latest ideas on improved propeller fan construction are embodied in the wonderful mechanical perfection of these fans. The motors are of the protected type, provision being made for easy accessibility and inspection of working parts within motor by removal of end hood cover. The motor windings are protected against dirt, grease, acids, or other foreign substances from entering therein.

Patent Rotor-Centering bronze bearings are used on all multi-phase fan motors 36" size and above, the rotor and shaft can be re-centered by one-half turn of outer bushing without removing the motor end hood; also shafts have exceptionally large diameters.

All sizes carried in stock for quick shipments

Easiest to Install **Neatest in Appearance** **Quietness of Operation**

Manufactured by

BATTERMAN TRUITT CO.

736-38 W. Monroe Street

CHICAGO, ILL.

Cleveland Office: 30 Euclid Arcade Bldg.

Philadelphia Office: W. I. Cheyney, Heed Bldg.

Carrier Equipped

buildings for **Public—Industrial**—and **Office** use are

COOL IN SUMMER
WARM IN WINTER

and have an abundant supply of pure, fresh air all the time.

Other systems may be cheaper—other guarantees may be higher—but **results** are what count. And to be sure of getting the **best results** specify

CARRIER

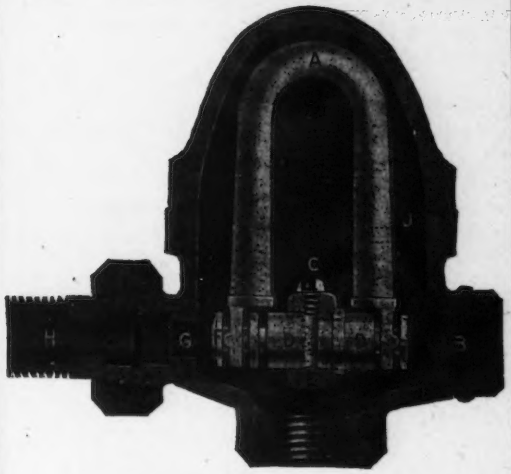
There is no equal.

Shall we send our engineer —or catalog 13-36?

Both are waiting to tell you WHY.

CARRIER AIR CONDITIONING COMPANY OF AMERICA
Buffalo, N. Y.

New York Boston
Chicago Philadelphia



HAINES VENTO TRAP

Recommended for use with cast iron radiation with low pressure steam. Not exceeding 10 lbs.

Built Right in the First Place

¶ That's why it has not been necessary to change the principle of this thermostatic tube a particle during more than 18 years it has been in use.

All HAINES Automatic VALVES and TRAPS

are guaranteed absolutely for a period of five years, when used on vacuum or low pressure heating systems.

Send for latest Catalogue

WM. S. HAINES & CO.
PHILADELPHIA, PA.

American Blower Co., Detroit, Mich., reports that 125 of its men are now in government service.

Hoffman Specialty Co., Chicago, Ill., announces the removal of its New York branch to new quarters at 512 Fifth Avenue, at the corner of Forty-third Street. E. C. Storms is in charge. Included in the company's display is the new Hoffman equalizing loop for vapor heating systems which has just been placed on the market. George D. Hoffman, president of the company, who was in New York, arranging for the removal, has left for his home in Pasadena, Cal. His son, Paul G. Hoffman, has received a commission as an officer in the reserve corps, and will shortly be in active service.

Enameling & Stamping Corporation, New York, announces the establishment in Long Island City of the largest enameling works in the east devoted exclusively to the service of manufacturers for work of this character. It is stated that hitherto no facilities of this size have been available in New York.

H. W. Johns-Manville Co., New York, announces the removal of its Houston, Texas, branch to 424-426 Washington Avenue, Houston.

McMann Supply Co., New York, has been sold to Charles H. Hirschfeld and George Steller and the location changed from Gold Street to 319 Pearl Street, New York. Mr. Steller has been associated with the McMann Company since 1888. Mr. Hirschfeld organized the Central Plumbers' Supply Company in 1904. He recently sold his interests in that concern to form his new partnership with Mr. Steller.

Braemer
Air Conditioning Corporation
Air Purifying—Air Cooling—Humidifying—Dehumidifying—Industrial Ventilation—High and Low Temperature Drying—Generator Coolers—Dust Removal—Reclamation.
Webster Air Washers
LAFAYETTE BLDG.
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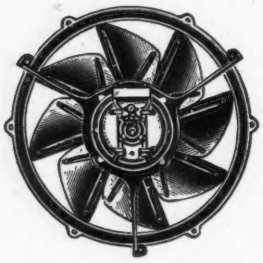
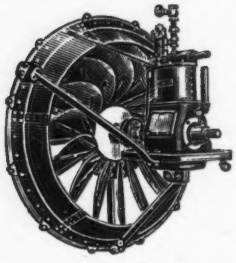
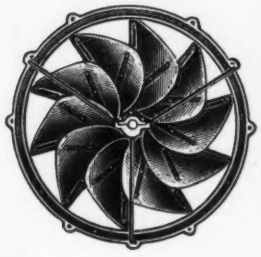
JAMES M. SEYMOUR
NEWARK - NEW JERSEY - U. S. A.
ELECTRIC DRIVEN STEAM DRIVEN BELT DRIVEN







Send for Bulletin No. 121, Jan. 1917

SEYMOUR FANS are the most durable and efficient air moving machines to be had in this country. Built in seven styles and fifteen sizes, 18-inch to 168-inch fans in stock. Capacity 1000 cubic feet to 150,000 cubic feet per minute.

Ventilating systems to suit all conditions. Dust Collectors, Humidifiers, Dry-Rooms to dry anything from bricks to sponges.

AIR CONDITIONING

JAMES M. SEYMOUR, 5-7-9-11-15-17-19 Kirk Place, NEWARK, N. J.

Work in a Cool, Properly Ventilated Factory this Summer

Wouldn't you "fall for" an advertisement like this if you were looking for a job? Certainly.

In the face of the labor shortage, the control of temperature and ventilation that the CARRIER SYSTEM makes possible, is going to be a big asset in getting and keeping the right sort of help this year. Besides making your plant a preferred place to work in, the CARRIER SYSTEM of humidifying, cooling and ventilating, eliminates the weather as a factor affecting production and makes possible an all-year-round maximum out-put, both as regards quality and quantity. The CARRIER SYSTEM has been introduced in practically every industry and is being successfully used in all parts of the United States and Canada.

Why let the labor shortage or the bug bear of the "dog days" this summer worry you, when both problems can be solved by the CARRIER SYSTEM.

Its operation in your plant and the benefits it will yield, can be easily determined by our engineers, who will gladly give you their advice without charge.

Carrier Engineering Corporation

39 Cortlandt St., New York

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

Chicago: Transportation Bldg.
Boston: 176 Federal St.
Buffalo: 1050 Ellicott Square
Philadelphia: Land Title Bldg.

Carrier AIR CONDITIONING AND DRYING EQUIPMENT

Saving Coal

We have been "fuel conservation specialists" for thirty years. During this period we have been directly interested in more than 11,000 successful heating systems and over 7,000 power plants, in which the aggregate saving of fuel may be stated in hundreds of thousands of tons yearly.

If you are operating your engines under back-pressure, or if you are having difficulty in circulating steam for heating, you are wasting steam, which means increased fuel consumption. These difficulties can be remedied. Let us show you how to SAVE ENGINE POWER by the removal of back-pressure, thereby increasing the efficiency of the heating system by better circulation, and eliminating water-hammer, air-binding and other objectionable features.

If you are interested in a heating system or a feed water heater for an industrial plant, hotel, office building, in fact—any building of fair size—an investigation of your present installation and operating conditions may lead to economies which cannot and should not be overlooked.

We are at your service with a trained engineering organization and branch offices in thirty cities. We have made fuel conservation a life-study and can determine and report candidly whether improvements are justified by assured results.

Write us for further information. No charge—and no obligation—for preliminary advice.

Address Department G-37

WARREN WEBSTER & CO.

Camden, New Jersey

Fuel Conservation Specialists Since 1888

New York International Exposition.

For the purpose of providing the manufacturers of the United States with a market place where they may meet the foreign buyers who are now coming to New York from all parts of the world, the New York International Exposition of Science, Arts and Industries, which has been under construction at East 177th Street and the Bronx River, New York, has just been opened to the public. The exposition is to be a permanent affair, along the lines of Shephard's Bush, London, and the annual trade conference of Lyons, France. The exposition season each year will extend from May 30 to November 1.

Twenty-seven acres are included in the exposition site, and among the exhibit buildings are a Palace of American Achievements, Palace of Fine Arts, Liberal Arts and Varied Industries.

Fourteen 600-H. P. Machines

One Shipment

Draining heated apparatus and feeding the condensate directly into boilers at temperatures over 300° in some instances

Send for our catalogue showing 12 types of machines and 25 system designs

FARNSWORTH CO.

Conshocken, Pa.